WILDLIFE AND WILDLIFE HABITAT LOSS ASSESSMENT AT COUGAR DAM AND RESERVOIR PROJECT SOUTH FORK MCKENZIE RIVER, OREGON

FINAL REPORT

By

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ABSTRACT

A habitat based assessment was conducted of the U.S. Army Corps of Engineers' Cougar Dam and Reservoir Project on the South Fork McKenzie River, Oregon, to determine losses or gains resulting from the development and operation of the hydroelectric related components of the project. Preconstruction, postconstruction, and recent vegetation cover types of the project site were mapped based on aerial photographs from 1953, 1965, and 1979, respectively. Vegetation cover types were identified within the affected area and acreages of each type at each period were determined. Fifteen wildlife target species were selected to represent a cross-section of species groups affected by the project. An interagency team evaluated the suitability of the habitat to support the target species at each time period. An evaluation procedure which accounted for both the quantity and quality of habitat was used to aid in assessing impacts resulting from the project. The Cougar Project extensively altered or affected 3,096 acres of land and river in the McKenzie River drainage. Impacts to wildlife centered around the loss of 1,587 acres of old-growth conifer forest and 195 acres of riparian hardwoods. Impacts resulting from the Cougar Project included the loss of winter range for Roosevelt elk, and the loss of year-round habitat for black-tailed deer, black bear, cougar, river otter, beaver, spotted owl, and other nongame species. Bald eagle and osprey were benefited by an increase in foraging habitat. The potential of the affected area to support wildlife was greatly altered as a result of the Cougar Project. Loses or gains in the potential of the habitat to support wildlife will exist over the life of the project.

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I. INTRODUCTION

This loss statement addresses the impacts to wildlife resources resulting from the development and operation of the hydroelectric-related components (e.g., dam, reservoir) of U.S. Army Corps of Engineers' (USACE) Cougar Project. The study was funded by Bonneville Power Administration and was designed to meet requirements of Measure 1004(b)(2) of the Columbia River Basin Fish and Wildlife Program adopted by the Northwest Power Planning Council pursuant to Section 4(h) of the Northwest Electric Power Planning and Conservation Act of 1980.

The objectives of the study were to: 1) provide for consultation and coordination with interested parties, 2) identify probable effects of past development and operation of the Cougar Project to wildlife and wildlife habitat, and 3) determine the hydroelectric portion of the wildlife resource losses at the Cougar Project. A habitat based approach was used to identify effects of the project and to determine losses or gains in the potential of the project area to support wildlife.

II. STUDY AREA

A. Project Description

Cougar Dam and Reservoir are located at river mile 4.4 of the South Fork McKenzie River in Lane County, Oregon. The project is 42 miles east of Eugene within the boundary of the Willamette National Forest (USACE 1982). The Cougar Project is within the Oregon Department of Fish and Wildlife (ODFW) McKenzie Management Unit, and the Blue River Ranger District of the Willamette National Forest.

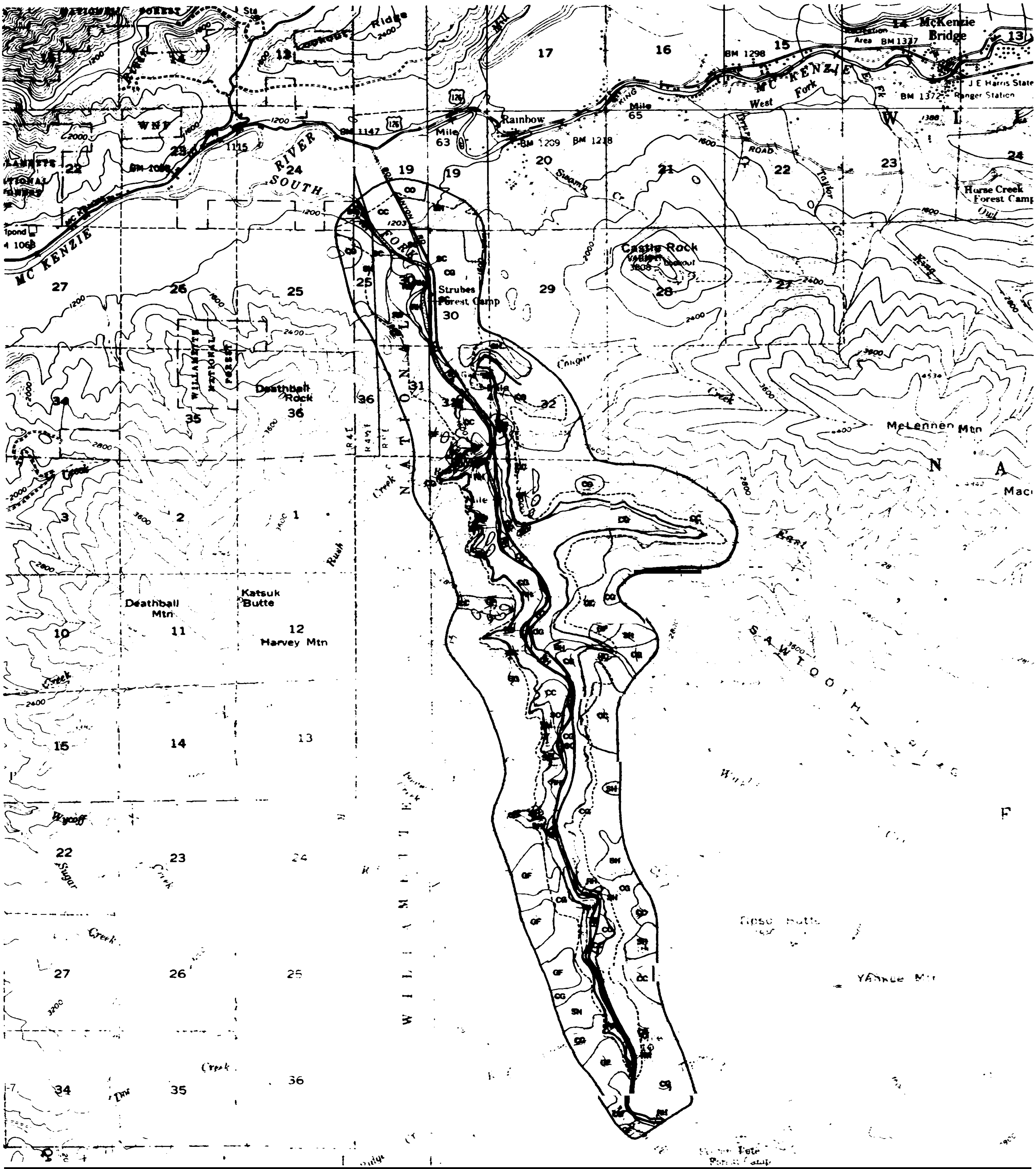
The project structure is a rockfill dam with an impervious earth core, 445 feet high with a crest len th of 1,738 feet. Power is generated by two 12,500 kilowatt turbines ((SACE 1982). The surface area of Cougar Reservoir is 1,280 acres at full pool level. The reservoir is 6.5 miles long and has a maximum width of 0.7 miles. Maximum pool elevation is 1,699 feet and minimum power tool elevation is 1,516 feet (USACE 1980).

Cougar Dam and Reservoir Project was authorized by the Flood Control Act of 1950. The 1954 Flood Control Act authorized the development of power at the project. Construction began in 1956 and flood control commenced in 1963. The Cougar Project was considered complete in 1964 when the power generators went into operation (USACE 1964).

B. Study Area Description

The "affected area" referred to in this report was most intensively studied and included that area directly affected by project construction and operation. The affected area encompassed the reservoir, project facilities, staging areas, and relocated roads (Figures l-3). Areas not directly affected by the project, but within the range of species using the project area, were considered when determining qualitative impacts.

Figure 1



Vegetation cover types of the Cougar Reservoir area (preconstruction, 1953).

CO	Temperate conifer forest, open	SH	Shrubland
CC	Temperate conifer forest, closed	GF	Grass-forb
CG	Temperate conifer forest, old growth	RA	Red alder
HC	Conifer-hardwood forest	SC	Sand/gravel/cobble
RS	-	DB	Disturbed/bare/rock
RH	Riparian hardwoods		River

--------- **Affected Area**

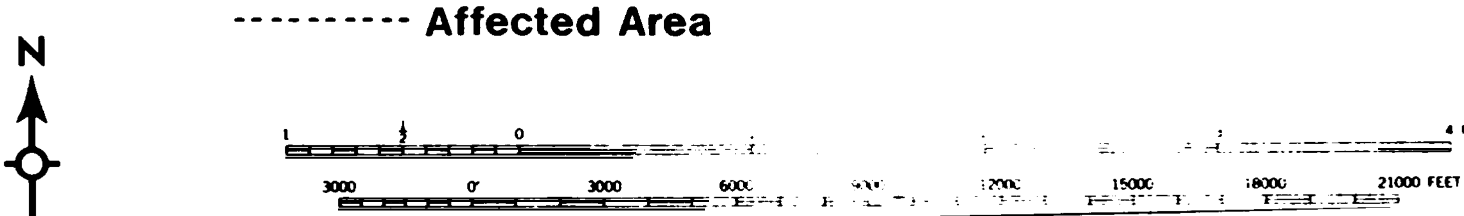
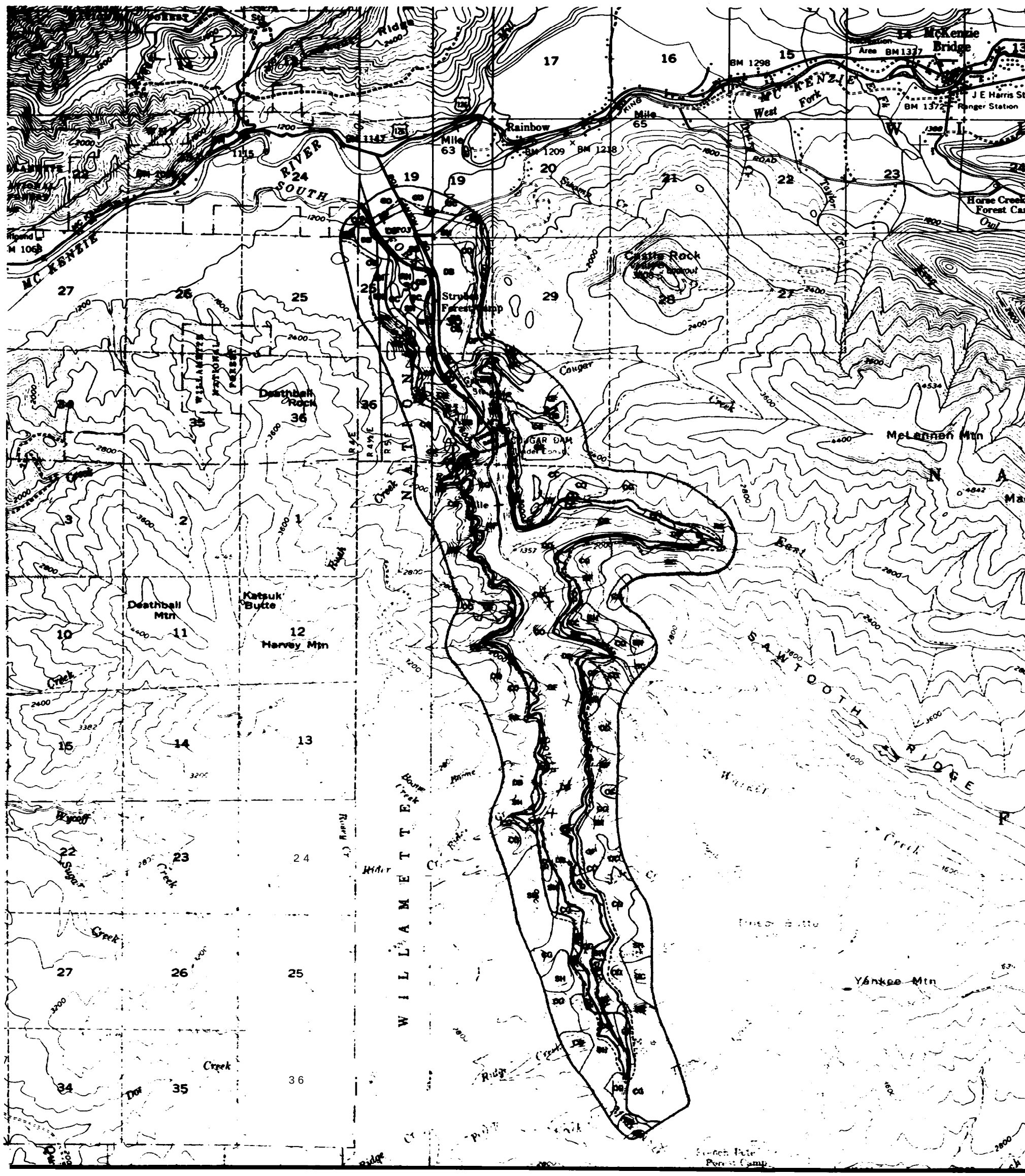


Figure 2



Vegetation cover types of the Cougar Reservoir area (postconstruction, 1965).

CO	Temperate conifer forest, open	SH	Shrubland
CC	Temperate conifer forest, closed	GF	Grass-forb
CG	Temperate conifer forest, old growth	RA	Red alder
HC	Conifer-hardwood forest	SC	Sand/gravel/cobble
RS	Riparian shrub	DB	Disturbed/bare/rock
RH	Riparian hardwoods		River

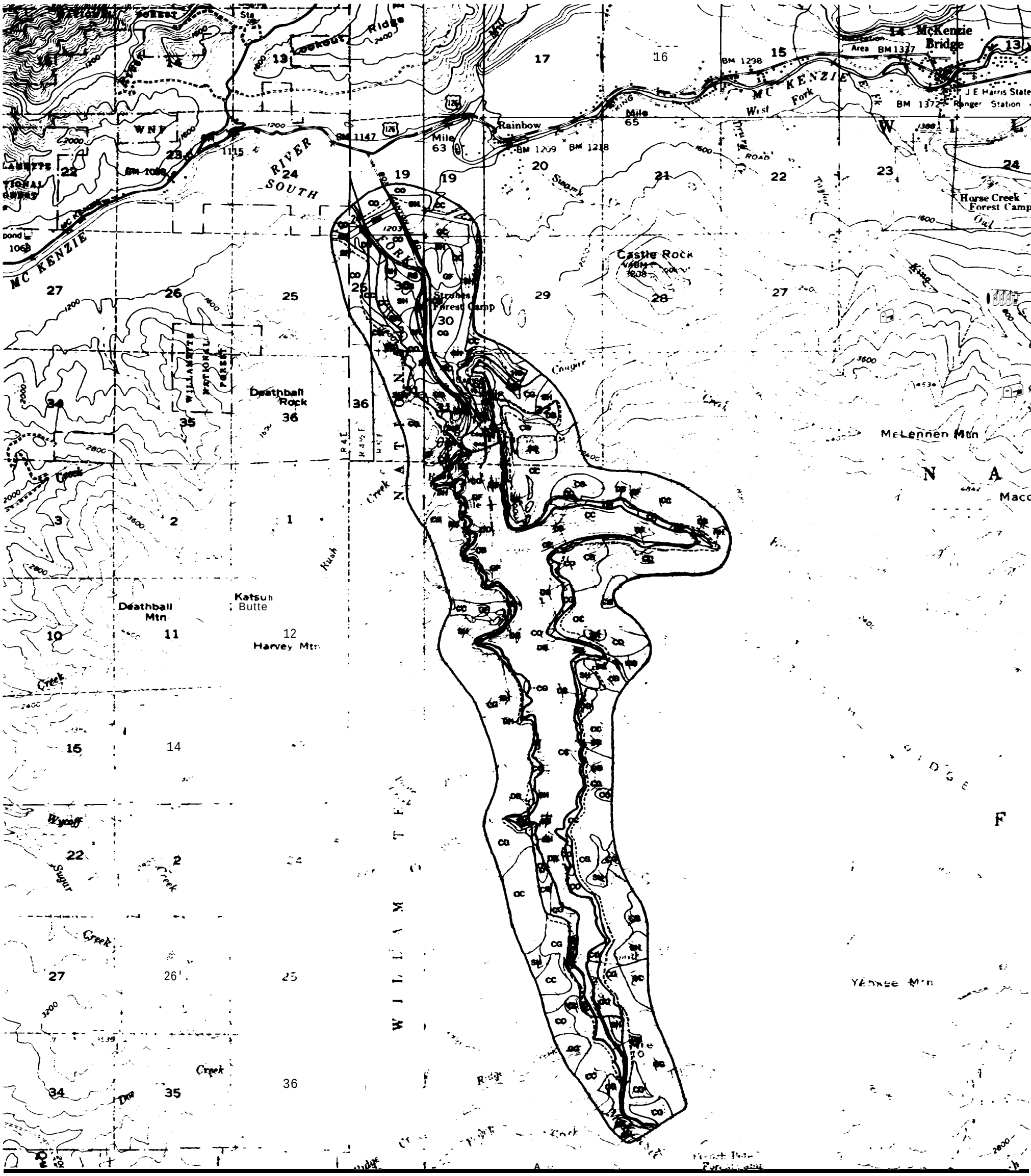
------ Affected Area

N

1 ½ 0 1 MILES

3000 0 3000 6000 9000 12000 15000 18000 21000 FEET

Figure 3



Vegetation cover types of the Cougar Reservoir area (recent, 1979).

CO	Temperate conifer forest, open	SH	Shrubland
CC	Temperate conifer forest, closed	GF	Grass-forb
CG	Temperate conifer forest, old growth	RA	Red alder
HC	Conifer-hardwood forest	SC	Sand/gravel/cobble
RS	Riparian shrub	DB	Disturbed/bare/rock
RH			River

------ Affected Area

N

The Cougar Project is located in the Western Hemlock Zone described by Franklin and Dyrness (1973). The reservoir site was characterized by stands of Douglas-fir, western red cedar, and western hemlock. Scattered stands of bigleaf maple and cottonwood occurred along the river. Common understory vegetation included red alder, vine maple, Pacific dogwood, willows, rhododendron, Oregon grape, and various grasses and forbs (U.S. Fish and Wildlife Service [USFS] 1961). More detailed descriptions of vegetation cover types are provided in Section IV.A.1. of this report. The lands surrounding the project site is steep with slopes often greater than 20-30% along the shoreline (USACE and U.S. Forest Service [USFS] 1965).

Roosevelt elk and black-tailed deer inhabited the project site prior to project construction. Black bear, cougar, bobcat, beaver, river otter, mink, raccoon, gray fox, and skunk inhabited the reservoir area, as did blue grouse, ruffed grouse, mountain quail, and band-tailed pigeon (USFWS 1959, R. Jubber, ODFW, pers. commun.). Preconstruction information on nongame species was not documented. In addition to those species documented to be present prior to construction, the affected area potentially supported many more wildlife species (Appendix A).

C. Land Ownership

USACE is responsible for 220 acres of land adjacent to the reservoir which are necessary for operational purposes. USFS manages activities on the 1,280-acre water surface of the reservoir and administers land contiguous to the reservoir within the National Forest boundary (USACE 1973, 1983).

III. METHODS

A. Consultation and Coordination

A list of agencies and their representatives interested in participating in the consultation/coordination process was developed and updated throughout the study. Parties on this list received correspondence informing them of the project effort and of consultation/coordination meetings. Participating agencies and individuals were contacted by phone or in person repeatedly throughout the study. Meeting minutes, draft species lists, target species lists, vegetation cover type descriptions, acreage tables, habitat rating system descriptions, and sections of the draft report were provided to those agencies and individuals expressing interest in the loss statement. Study procedures, the species list, target species, vegetation mapping, and report drafts were discussed at meetings and comments were requested and documented. Interested agencies were represented by participants in the habitat rating process (see Section 1II.E.).

B. Vegetation Cover Type Mapping

Preconstruction, postconstruction, and recent vegetation cover types of the Cougar Reservoir areas were mapped based on aerial photographs from 1953, 1965, and 1979 obtained from USACE in Portland. All photographs were black and white and scales varied from 1:5,500 to 1:30,000. The base map was derived from 1:62,500 USGS quadrangle maps, enlarged to

1:24,000 and screened on mylar film. The area extended 1/4 mile from the full pool reservoir shoreline. Vegetation cover types were based on categories described by Hall et al. (1985) and are described in section IV.A.1.

The aerial photographs were overlaid with mylar film and examined under a stereoscope. Areas of discernibly similar vegetation cover were outlined (polygons) and labeled with a symbol designating cover type. These designations were checked against timber type maps obtained from the Willamette National Forest and photographs taken during site visits. The polygons on the overlays were then transferred to the base map using known landmarks, slope, ridge and valley topography, and proportional dividers to locate each polygon accurately.

The recent map was ground truthed on 23 November 1984. Cover type categories designated on the map were visually verified and if necessary, changes were made to the draft recent map, then to postconstruction and preconstruction maps. All maps were then finalized and traced onto mylar overlays to the base map. A boundary including only the area directly affected by the project was determined from analysis of the aerial photographs and vegetation maps and was drawn on the base map. Acreages of map categories within the affected area boundary were calculated from blackline reproductions of the three maps, using the known area of the reservoir as a basis for assigning acreages to polygons. The affected area was narrow and contained many small polygons; therefore, a dot grid was used to calculate acreages. Dot counts among the three maps agreed within 4%m and counts of the reservoir surface only differed by 0.3% indicating good accuracy had been obtained.

C. Literature Review and Interviews

ODFW, USFWS, and USFS files were examined for wildlife/habitat information relevant to the Cougar Project area. An extensive review of journal articles was conducted to locate research findings pertinent to the project area. Much of the available information on the status of wildlife populations during the preconstruction and postconstruction periods was identified in the status report on wildlife mitigation at Cougar Reservoir (Bedrossian et al. 1984). Interviews were conducted with ODFW, USFWS, and USFS biologists, and other individuals knowledgeable of wildlife/habitat conditions in the project area.

D. Target Species

Wildlife species potentially occurring in the project area (Appendix A) were identified based on a list of wildlife in the Willamette National Forest (USFS undated) and on the Oregon nongame wildlife management plan review draft (Marshall 1984). From these lists, target species were selected based on factors such as threatened or endangered status, priority according to State or Federal programs, recreational or economic importance, or degree of impacts resulting from the project. Target species selected represent a cross-section of species groups (species that have similar habitat requirements) affected by the project and were used to evaluate the losses or gains in the potential of the project area to support wildlife.

E. Impact Analysis

The method used to aid in evaluating the loss or gain of wildlife habitat as a result of the Cougar Project was based on the "Habitat evaluation procedure" developed by USFWS (1976, 1980), "Ecological planning and evaluation procedures" developed by the Joint Federal-State-Private Conservation Organization Committee (1974), and discussions with various USFWS, USACE, and ODFW personnel.

For each target species, the acres of cover types potentially used within the affected area were totaled to determine the acres of habitat available to each target species at preconstruction, postconstruction, and recent time periods. Tables summarizing the cover types and acreages available to each target species were prepared. Habitat rating criteria worksheets providing information on habitat requirements were prepared for each target species and are available from ODFW. The worksheets provided a standard from whih ratings were based.

Participating agencies designated individuals having expertise on the project area and/or target species to attend the habitat rating meeting (Appendix B). Each person was provided with habitat rating criteria worksheets, drafts of the background information sections of the loss statement report, and tables of cover type acreages. Cover type maps and aerial photos were available and were consulted frequently during the rating session. The habitat rating group spent one day touring the project area, looking at habitat that was similar to that altered by the project, and discussing preconstruction, postconstruction, and present habitat conditions as well as target species. At the rating session, acres of habitat available for each target species were agreed upon, based on cover types, location, and other factors (e.g., forest stand condition) which might indicate whether an area was used as habitat. Once the available habitat was identified, the quality of the habitat at preconstruction, postconstruction, and recent time periods was rated on a scale of 1 to 10 (l=low quality habitat, 5=average quality habitat, lO=optimum habitat) for each target species. Ratings were derived from the site visit, aerial photographs, vegetation maps, habitat requirements of the target species, and the biologists' expertise. Reasons for assigning each rating were documented and are discussed in this report. Factors other than hydroelectric development and operation that may have influenced the value of the habitats were considered but did not affect the assigned ratings unless otherwise noted in the text of this report.

The ratings for each target species at each time period were then divided by the optimum habitat value (10) to provide a habitat suitability index. The habitat suitability index was then multiplied by the number of acres of habitat available to that species at that time period to determine habitat units (HU's) available. HU's provide a relative index of the importance of the habitat to that particular species. One HU is equal to one acre of optimum quality or prime habitat for that species.

HU's available to each target species prior to project construction were subtracted from available postconstruction HU's to determine the loss or gain of the potential of the habitat to meet the requirements of each target species as a result of project construction. Preconstruction HU's also were subtracted from recent HU's to determine the loss or gain of the potential of the habitat to support the target species 15 years after project construction. When the number of HU's lost or gained at postconstruction was different from the number of HU's lost or gained at the recent time period, the reason for the difference (such as revegetation of an area that was disturbed during construction) was determined and documented. The HU's lost or gained represent the change in the potential of the habitat to support the given species at one point in time. That potential, however, was lost or gained over the entire life of the project. To simplify the loss statement and loss/gain accounting process, the loss or gain at the recent time period was used in the report summary.

Other factors such as density estimates, impacts not directly affecting habitat quality, and impacts resulting from other causes were analyzed when information was available and are discussed in the text of this report. Losses incurred were considered relative to benefits.

IV. RESULTS AND DISCUSSION

A. Vegetation Cover Types

1. Descriptions

Thirteen cover types were identified in the Cougar Project area and acreages within the affected area were calculated for each (Table 1, Figures 1-3). The most prominent type of vegetation was temperate conifer forest, which was divided into 3 vegetation cover types: open, closed, and old-growth. Major tree species in all three were Douglas-fir and western hemlock. There were various inclusions of incense cedar, western red cedar, ponderosa pine, bigleaf maple, red alder, madrone, and Oregon white oak, depending on moisture, slope, aspect, elevation, soils, and past disturbance. Crown closure was the criterion used in distinguishing among the 3 conifer types.

a. Temperate conifer forest, open

Open temperate conifer forest stands comprised less than 1% of the affected area prior to project construction and about 6% after construction. Overstory crown closure was less than 70% and often these stands were in areas where selective cutting or other disturbance had occurred. At higher elevations, these stands occurred on rocky or extremely steep slopes. At the north end of the Cougar Reservoir study area, open stands had a well developed understory dominated by rhododendron and salal, with a number of fair-sized stumps in evidence.

b. Temperate conifer forest, closed

Stands of closed temperate conifer forest varied from pole-sized trees to large sawtimber, but in all cases crown closure was 70% or more over

Table 1. Acreages of cover types within the affected area 1 during preconstruction, postconstruction and recent conditions and losses and gains in acreages from preconstruction to postconstruction and preconstruction to recent conditions, Cougar Reservoir, Oregon.

Vegetation Cover Type/ Map Category	Pre-costruction (1953)	Post-construction (1965)	Recent (1979)	Loss or gain (+ or -) Pre to Post-construction	Loss or gain (+ or -) Pre to Recent
	Acres	Acres	Acres		
Temperate conifer forest, open	24	200	314	+176	+290
Temperte conifer forest, closed	460	80	326	-380	-134
Temperate conifer forest, old-growth	1,876	289	289	-1,587	-1,587
Conifer-hardwood forest	4	7	20	+3	+16
Riparian shrub	18	5	22	-13	+ 4
Riparian hardwood	233	41	38	-192	-195
Shrubland	246	233	298	-13	+52
Grass-forb	59	249	83	+190	+24
Red alder	0	0	10	0	+10
Sand/gravel/cobble	34	6	0	-28	-34
Distrubed/bare/rock	35	670	380	+635	+345
River	107	36	36	-71	-71
Resewoir	0	1,280	1,280	+1,280	+1,280
TOTALS	3,096	3,096	3,096		

1 The "affected are: was the area directly affected by project construction and opertion and included the reservoir, project facilities, staging areas, and relocated roads.

the major part of the mapped stands. No attempt was made to distinguish between young and old stands because of study time limitations. However, in general, closed stands on the east side of Cougar Reservoir were large sawtimber, while those on the west side were small sawtimber or poles. For instance, young sawtimber and pole stands in the southwest part of the study area in 1979 can be traced back to clearcuts which appear on both the preconstruction and the postconstruction maps. The affected area consisted of 15% closed conifer stands prior to construction and 3% after construction.

C. Temperate conifer forest, old-growth

This was the most widespread vegetation cover type in the Cougar Reservoir study area prior to construction, comprising over 60% of the affected area. After construction, old-growth made up about 9% of the affected area. Old-growth stands were characterized by decay, numerous snags, canopy openings, and abundant dead and down woody material. Overstory trees were large in diameter and the tree canopy often consisted of 2 or more stories (Hall et al. 1985).

d. Conifer-hardwood forest

These stands were mixtures of conifers and hardwoods (e.g., red alder, bigleaf maple, madrone) with the latter contributing 30-70% of the crown cover (Hall et al. 1985). In the Cougar Reservoir study area, these stands usually occurred along water courses and appeared to be stable communities. One stand, just north of Cougar Dam, was on rock terraces cut during dam construction and appeared to be a seral community. The affected area contained less than 1% conifer-hardwood forest prior to and after project construction.

e. Riparian shrub

This category was limited to shrubby areas along the banks of the river and on sand and gravel bars, and comprised less than 1% of the study area prior to and after project construction. Vegetation consisted of seedling willows and black cottonwood, with scattered forbs. Most of the riparian shrub stands should be considered ephemeral, as they occurred where high water could erode them away after a few years. A few stands might develop into riparian hardwood communities, depending on channel changes.

f. Riparian hardwoods

Black cottonwood was an important component of the stream or lake shore vegetation in this cover type. Other deciduous species were sometimes present, as were conifers. No particular cover limits were assigned to black cottonwood. At Cougar Reservoir, riparian hardwoods occurred on alluvial stream terraces above the reservoir and along the river below the dam. These stands appeared to be seral stages of temperate conifer forest, although flooding and channel changes could maintain the species composition for extended periods. Stands where black cottonwood were more than 10-15 feet tall and in greater abundance than red alder were included in this category. The affected area contained 8% riparian hardwood prior to construction and about 1% after construction.

g. Shrubland

The affected area contained 8% shrubland prior to and following construction. Shrub communities had 40% or more woody crown cover but woody vegetation was less than 15 feet tall (Hall et al. 1985). Often shrub communities were dominated by seedling conifers and were a seral stage in the regeneration of the temperate conifer forest. Shrubland in the southwest part of the mapped area was in the grass-forb category prior to construction. In some cases, however, thin soils or steep unstable slopes may have prolonged the shrub stage indefinitely. Such was probably the case on the south-facing slope above Slide Creek, where little change occurred between 1953 and 1979.

h. Grass-forb communities

Two types of grass-forb communities were mapped in the Cougar Reservoir study area. Most map units in this category represent the first stage of revegetation of disturbed areas. They occurred downslope of the road around the reservoir and in clearcuts on the slopes above the reservoir. Woody plant cover was less than 40% (Hall et al. 1985). Tree seedlings were usually present. The other type of grass-forb community occurred on rock outcrops and included abundant mosses. The soils were thin and patches of bare rock were common. Practically no shrubs or tree seedlings were present. The grass-forb cover type comprised 2% of the affected area prior to construction, 8% directly after construction, and 3% in 1979.

i. Red alder

Only 1 stand dominated by red alder occurred in the Cougar Reservoir study area, comprising less than 1% of the affected area in 1979. The stand became established as a result of disturbance on a site with thin rocky soil. The mapped stand was even-aged and dense, with few shrubs and a grass-forb understory.

j. Sand/gravel/cobble

These areas occurred along the river and are probably under water during spring runoff and other periods of high water. Their extent would therefore vary with river level. They comprised about 1% of the affected area prior to construction and less than 1% after construction. They may have supported sparse herbaceous growth, but did not show signs of being heavily vegetated on aerial photographs.

k. Disturbed/bare/rock

This map category included naturally barren areas as well as those where severe or continued disturbance prevented the re-establishment of vegetation. The acreage was somewhat understated because of numerous vertical or near-vertical cliffs in the study area which were too narrow in horizontal projection to appear on the maps. The large rock outcrop which anchors the east end of Cougar Dam was the only natural feature to

fall into this category. The rest of the areas mapped in this category were the result of reservoir or road construction or continuing human activity. The affected area contained 1% of this cover type prior to construction, 22% directly after construction, and 12% in 1979.

1. River

The area in this category included the main river channel only. Tributaries were too narrow to show up on the map and/or aerial photographs and therefore were not included in the acreage figures. River comprised over 3% of the affected area prior to construction and 1% after construction.

m. Reservoir

The area mapped as reservoir included the full pool level of the reservoir. During lower water levels, the drawdown zone, with a maximum vertical range of 183 feet, is exposed. Fluctuating water levels have not been conducive to the establishment of vegetation within this zone. Except for approximately 10 acres of sedges and/or reed canary grass at the upper end of the reservoir and on relatively level areas near Slide Creek, the drawdown zone is barren during low water levels. The reservoir makes up 41% of the affected area.

2. Changes resulting from the project

Cougar Reservoir inundated 1,280 surface acres. The actual land base lost was, of course, greater than the reservoir surface acreage. Over 5 6 miles of the South Fork McKenzie River and an undetermined number of miles of tributary streams were inundated. Surrounding land was altered by relocated roads, project facilities, and construction activities. Cover types reduced in acreage were old-growth, riparian hardwood, closed conifer forest, sand/gravel/cobble, and river (Table 1). Considerably more old-growth (1,587 acres) was eliminated than any other cover type. Old-growth forests in the Pacific Northwest support diverse and abundant wildlife populations and provide optimum habitat for up to 18 bird and mammal species (Meslow et al. 1981). The reduction of old-growth stands in the Pacific Northwest is of serious concern to wildlife managers. Riparian vegetation associated with rivers and streams is also considered to be of importance by wildlife managers. Riparian habitat is generally thought to provide for higher density and diversity of wildlife than most other habitats. Over 195 acres of riparian hardwood stands were eliminated within the area directly affected by the Cougar Project. In addition, a reduction of riparian habitat downstream from the project may have occurred as a result of the Cougar Project and/or effects of the Willamette Reservoir System. The effects of the loss of the previously mentioned cover types within the area directly affected by the project is discussed in greater detail in the Target Species sections of this report.

Cover types which increased within the affected area included the reservoir, disturbed/bare/rock, open conifer forest, and grass-forb. As a result of natural revegetation and succession during the years following project construction, disturbed/bare/rock and grass-forb cover types

developed into open conifer forest, closed conifer forest, conifer-hardwood forest, riparian shrub, shrubland, and red alder on about 450 acres of the area surrounding the reservoir.

Changes have occurred in the Willamette Basin since the time of project construction as a result of increased timber harvest and increased human development. It has not been possible to estimate how much of the area directly affected by the project might have been logged if the project had not been constructed. Timber management plans for the area prior to project construction could not be found. The "multiple use management plan for the Blue River District" (USFS 1968) did state that the management objective for the South Fork McKenzie River Drainage in areas viewed at a distance from heavily traveled roads, trails and recreation developments, and from viewpoints adjacent to Cougar Reservoir, was to maintain or develop an attractive appearing forest. It is not possible to say how management of the area would have been different without the project. The potential to manage the area for wildlife would exist if the project had not been constructed. Because the project was constructed, the potential for the inundated area to support many species of wildlife was eliminated.

B. Target Species

1. Roosevelt elk

a. Importance

The Roosevelt elk is a major big game species in western Oregon. Approximately 51,216 hunters participated in seasons for Roosevelt elk in 1983. The McKenzie Wildlife Management Unit, in which the project is located, provided 11,365 hunter-days of recreation during the 1983 elk hunting seasons (Ingram 1984). Roosevelt elk require a variety of habitat types for survival from open areas to old-growth forest (Witmer et al. 1985). Prior to construction, the Cougar Project site provided elk winter range of particular importance during relatively severe weather conditions (USFWS 1959). The Roosevelt elk was chosen as a target species for this study, because of management emphasis, recreational value, loss of winter range due to the project, and to represent other species with similar habitat requirements.

b. Habitat requirements

Open areas such as clear-cuts or burned areas, and natural openings found along streams or in old-growth forests provide elk forage such as grasses, forbs, and shrubs (Mace 1956, Swanson 1970, Cleary 1976, Witmer and deCalesta 1983). Critical to elk use of open forage areas is the proximity of cover. Elk use of open areas begins to decrease beyond 200 feet, and decreases rapidly beyond 600 feet from cover (Witmer et al. 1985). Forest stands provide escape cover as well as thermal relief from temperature extremes (Mace 1956; Harper 1966, 1971; Witmer and deCalesta 1983). Sapling-pole forests provide security during hunting seasons and thermal relief during the warm summer months (Mace 1956, Witmer and deCalesta 1983). Old-growth forests provide reduced snow depths and maintenance forage during severe winter weather, in addition

to escape and thermal cover (Starkey et al. 1982, Witmer and deCalesta 1983, Witmer et al. 1985). Snow depths of 18 inches or more can impede elk movement and bury most forage in forest openings, therefore, old-growth stands are particularly important to elk during winter periods of deep snow (Witmer et al. 1985). Riparian habitats characterized by mixed conifer and hardwood vegetation are important foraging, loafing, travel, and watering areas (Starkey et al. 1982, Witmer and deCalesta 1983).

Use of plant species for forage varies with the seasons. Green grasses and forbs are heavily used by Roosevelt elk in spring and summer. Browse species are more important in late summer, fall, and winter (Mace 1956; Harper 1966, 1971). Vegetation use depends upon availability, but several species such as huckleberry, vine maple, salal, ceanothus, willow, and blackberry are important food sources for Roosevelt elk (Mace 1956; Harper 1966, 1971; Swanson 1970; R. Jubber, ODFW, E. Harshman, USFS, pers. communs.).

C. History in the project area

Elk were widespread throughout the Willamette Valley during the 1800's. Settlement and unrestricted hunting had decimated the elk population by 1900 (Mace 1956, Starkey et al. 1982). Beginning in 1905, elk hunting was not permitted in Oregon. By the mid-1930's, elk damage complaints indicated some populations of elk could support a limited harvest, and in 1938 Roosevelt elk were hunted for the first time since the closure (Mace 1956).

Estimates made of the Oregon elk population in 1932 indicated 800 animals in the Cascade Range, and 400 elk within Lane County (in both the Coast Range and Cascade Range) (Oregon State Game Commission [OSGC] 1933). In 1953, OSGC initiated a program to increase the number and distribution of Roosevelt elk in western Oregon (Mace 1971). By 1967, the estimated Roosevelt elk population in the Willamette Basin was 2,000 animals the majority of which were found in the McKenzie and Middle Fork Willamette River drainages (Aney 1967). The increase in elk numbers is mostly attributed to the increase in timber harvest in the Willamette Basin at that time.

Information is limited on elk populations in the project area prior to construction. The South Fork McKenzie River watershed upstream from the project site was (and still is) a major wintering area for Roosevelt elk. Elk used the project site during the winter, particularly during severe weather (USFWS 1959). Snow depths greater than 18 inches occur in the project area about every 3 to 4 years. Further up the South Fork about 1 mile above the upper end of the reservoir in the French Peter area snow depths over 18 inches occur most winters (L. Peterson, B. Leavitt, USFS, pers. communs.). USFS records indicate that prior to project construction a herd of about 50 elk wintered in the East Fork drainage and down into the reservoir site. The reservoir site was also used by a herd of about 20 elk from the Walker Creek drainage and a herd of about 12 elk from Indian Ridge (L. Agpaoa, USFS, pers commun.).

d. Assessment of impact

Prior to project construction, 2,920 acres of open, closed, and old-growth conifer forest, conifer-hardwood forest, riparian shrub and hardwood, shrubland, and grass-forb cover types were available to elk for winter use in the affected area (Table 2). Old-growth provided cover and maintenance forage for elk during harsh winter weather. Foraging areas were limited, reducing the potential of the habitat for supporting large numbers of elk for an extended period of time. The contiguous area of habitat with riparian vegetation along the South Fork drainage and its tributaries, limited human disturbance, and importance of the area in relatively severe winters contributed to the value of the habitat prior to project construction. The value of this elk winter range was given a rating of 7 (above average) by the interagency evaluation group. Following the impact analyses methods described in Section III.E., the rated value of the habitat (7) was divided by the optimum potential value (10) resulting in a habitat suitability index of .7. The habitat suitability index was then multiplied by the number of acres of habitat available (2,920), resulting in a habitat unit (HU) value of 2,044. One HU is equivalent to 1 acre of optimum habitat, therefore, the 2,920 acres of elk habitat within the affected area prior to construction were equivalent to 2,044 acres of prime elk habitat.

Upon completion of project construction, 1,104 acres of habitat were available to elk in the affected area (Table 2). The most important loss was in old-growth and riparian cover types. According to USACE (1979) "a significant amount of the available winter range for big game in this area" was lost. The interagency evaluation group rated the postconstruction habitat for elk 3 (below average). The habitat that remained was not contiguous, animal movement and migration was obstructed by the reservoir and roads around the reservoir. Project construction activity and associated disturbance reduced elk use of cover and forage sites at the Cougar Project. The relative value of the postconstruction elk habitat in the affected area was 331 US's, a loss of 1,713 HU's from the preconstruction value.

By 1979, 1,400 acres of habitat were available to elk. The increase in habitat was due to natural revegetation and seral advancement in the affected area. The value of the habitat as winter range was rated 4 (below average) by the evaluation group. Despite the increase in potential habitat, the value remained low because the affected area was used mostly for foraging and did not provide much thermal cover. In addition, roads bisected available habitat and human disturbance limited use of the area. The relative value of the elk habitat was 560 HU's, a loss of 1,484 HU's when compared to the preconstruction value of the affected area (Table 2). The decline in HU's for Roosevelt elk represents a loss in the potential of the project area to support elk and other wildlife species with similar habitat preferences or requirements.

Current USFS records indicate the South Fork McKenzie River drainage above the reservoir is used by approximately 70 elk as winter range (L. Agpaoa, USFS, pers. commun.). About 60 elk from 3 different herds use the South Fork drainage below the reservoir. Elk use the project area. According to USACE (1973) elk "are forced down to the very edge

Table 2. Roosevelt Elk: Acres of habitat available and lost, habitat ratings, and habitat units at Courar Project.

Cover Type	Pre-construction (1953)	Post-construction (1965)	Recent (1979)	Loss or gain (+ or -) Pre- to Post-construction	Loss or gain (+ or -) Presonstruction to recent
Temperate conifer forest, open	24	200	314	+176	+290
Temperate conifer forest, closed	460	80	326	-380	-134
TEmperate conifer forest, old-growth	1,876	289	289	-1,587	-1,587
Conifer-hardwood forest	4	7	20	+3	+16
Riaprian shrub	18	5	22	-13	+4
Riparian	233	41	38	-192	-1%
Shrubland	246	233	2%	-13	+52
Grass-forb	59	249	83	+190	+24
Red alder	0	0	10	0	+10
TOTAL ACRES	2,920	1,104	1,400	-1,816	-1,520
Habitat Rating	7	3	4		
HABITAT UNITS	2,044	331	560	-1,713	-1,484

of the reservoir" during severe winter weather. In the past, elk migrated along the South Fork drainage where the reservoir now exists. Elk migration now occurs along Quartz Creek drainage to the west, and further east and north on the east side of the reservoir. The changes in migration patterns indicate that elk migration was inhibited and/or blocked by the reservoir. The resulting effect can be direct mortality during severe winter weather conditions or at least additional expenditure of energy by elk during winter when energy conservation is most important.

The relocated roads adjacent to Cougar Reservoir receive logging traffic and provide access to recreationists. In addition to the loss or degradation of habitat, these roads can result in increased incidences of road kills or poaching, increased disturbance and hence greater energy expenditures, or total avoidance of the area by deer and elk.

2. Black-tailed deer

a. Importance

Black-tailed deer are pursued by more hunters than any other big game species in western Oregon. Deer hunting provided 104,675 hunter-days of recreation in the McKenzie Wildlife Management Unit during 1983 (Ingram 1984). Black-tailed deer prefer a variety of habitat types, from open areas to old-growth forest (Witmer et al. 1985). With inundation of the Cougar Project site, year-round habitat and important deer winter range was lost (USFWS 1979). The black-tailed deer was chosen as a target species for this study because of management emphasis, recreational value, loss of winter range due to the project, and to represent other species with similar habitat requirements. The black-tailed deer is a major big game species in Oregon and has different specific habitat requirements and preferences than elk. Therefore, black-tailed deer was selected as a target species in addition to Roosevelt elk, even though many basic habitat requirements are similar.

b. Habitat requirements

Black-tailed deer are associated with open areas, such as burns, clear-cuts, and natural openings found along streams or in old-growth forests, as well as brush, and edge habitat (Mace 1953, Aney 1967). These areas produce the grasses, forbs, and shrubs upon which deer forage. The value of these forage areas for deer is dependent upon the proximity to cover. Black-tailed deer remain near the edge between cover and open areas. Deer use of the open forage areas increases from the edge to 200 feet, then gradually decreases beyond 200 feet, and decreases rapidly beyond 600 feet from cover (Wilms 1971, Witmer et al. 1985). Hanley (1983) observed peak deer use of the open forage area approximately 550 feet from cover. Old-growth forest stands are used by deer for hiding cover and during adverse weather conditions because supplemental forage and thermal cover are provided (Lindzey 1943, Witmer et al. 1985). Old-growth stands are, therefore, especially important to deer during periods of deep snow, when depths of 18 inches or more impede deer movement and bury most forage in forest openings (Witmer et al. 1985). Riparian zones provide water, forage, and shade, and are

used as travel corridors by black-tailed deer. Riparian habitat receives greater use during fawning periods, dry summer months, and times of heavy snowfall (Witmer et al. 1985).

Use of plant species by black-tailed deer for forage varies depending on the season and availability. Wallmo (1981) conducted a study west of Corvallis, Oregon, and found that browse species were most frequently used, forb use increased in spring and summer, and grasses were consumed consistently in winter. Browse species such as trailing blackberry, huckleberry, and salal are important to black-tailed deer in the Coast Range (Lindzey 1943; Brown 1961; Miller 1966, 1968; Hines undated). The primary browse for black-tailed deer in the Cascade Range, Blue River Ranger District, is ceanothus. The most important species of ceanothus are deerbrush, redstem, and snowbrush (R. Jubber, ODFW, pers, commun.). Some of the highest quality deer winter ranges in the central and south Cascades contain one or more of these species (E. Harshman, USFS; R. Jubber, ODFW, pers. communs.).

C. History in the project area

Information available on deer populations in the project area prior to construction is limited. Deer wintered in the East Fork and Walker Creek drainages and down into the reservoir site (USFS files). OSGC (1948) estimated 5 deer per square mile occupied the McKenzie River watershed in 1948. Increased timber harvest and improved forage within the drainage at the time of construction probably provided for a larger population than this estimate indicates (R. Jubber, ODFW, pers. commun.). The deer population in the Willamette Basin peaked between 1955 and 1960 (Aney 1967) and about 5 years later in the McKenzie River drainage (R. Jubber, ODFW, pers. commun.). Spotlight counts conducted during April and May at the reservoir site during the construction period produced the following black-tailed deer numbers: 5.8 deer per linear mile in 1959, 9.8 per mile in 1960, and 4 deer per mile in 1962 (ODFW files).

In 1967, the estimated black-tailed deer population within the Willamette Basin was 135,000 (Aney 1967). ODFW estimated the 1980 black-tailed deer population in Lane County was 92,100 animals. With approximately 4,200 square miles of deer habitat within the county, the estimated density was 22 deer/square mile of habitat (ODFW files).

d. Assessment of impact

As with elk, it was assumed that the open-conifer, closed-conifer, old-growth, conifer-hardwood, riparian shrub, riparian hardwood, shrubland, and grass-forb vegetation cover types within the affected area were available to black-tailed deer (Table 3). The evaluation team rated the 2,920 acres of deer habitat 6 (above average) for year-round use resulting in a value of 1,752 HU's. The interspersion of open areas and cover and the availability of forage was not optimum for deer. The old-growth forest and riparian habitat present within the reservoir site was important winter range for both deer and elk. The affected area provided high quality thermal cover which was extremely important during the critical winter period. Deer could migrate up and down the South

Table 3. Balck-tailed Deer: Acres of bhbitat and lost, habitat ratings, and habitat at Courgar Project.

Cover Type	Pre-construction (1953)	Post-construction (1965)	Recent (1979)	Loss or gain (+or -) Pre- tio Post-construction	Loss or gain (+or -) Preconstruction to recent
Temperature conifer forest, open	24	200	314	+176	+290
Temperature conifer forest, closed	460	80	326	-380	-134
Temperature conifer forest, old-growth	1,876	289	289	-1,587	-1,587
Conifer-hardwood forest	4	7	20	+3	+16
Riparian shrub	18	5	22	-13	+4
Riparian hardwood	233	41	38	-192	-1%
Shrubland	246	233	2%	-13	+52
Grass-forb	59	249	83	+190	+24
Red alder	0	0	10	0	+10
TOTALS ACRES	2,920	1,104	1,400	-1,816	-1,520
Habitat Rating	6	3	4		
HABITATUNITS	1,752	331	560	-1,421	-1,192

Fork McKenzie drainage which was used as a travel corridor. Suitable fawning habitat was available within the affected area at the northern end, and human disturbance was much less than it is today.

In 1965, upon completion of the project, 1,104 acres of black-tailed deer habitat remained within the affected area. Forage may have been provided in the recently disturbed areas but little thermal cover was available. Disturbance from the road and human activity contributed to the rating of 3 (below average). A loss of 1,421 HU's resulted from construction of the project, with the remaining habitat having a value of 331 HU's.

Available black-tailed deer habitat increased to 1,400 acres by 1979 as a result of natural revegetation. The evaluation team rated this habitat 4 (below average) which resulted in 560 HU's. This was a loss of 1,192 HU's compared with the preconstruction value. The available habitat within the affected area still lacked a good mixture of open and closed cover types and winter thermal cover. Road traffic, increased accessibility, and human activity reduced the value of habitat available to black-tailed deer within the affected area. The Cougar Project eliminated "a significant amount of the available winter range for big game in this area" (USACE 1979). According to USACE (1973), during severe winter weather deer "are forced down to the very edge of the reservoir". The decline in HU's for black-tailed deer represents a loss in the potential of the project area to support deer and other wildlife species with similar habitat requirements.

3. Black bear

a. Importance

The black bear has been classified as a game mammal in Oregon for the past 20 years and provides recreation for sportsmen during harvest and pursuit seasons. ODFW collected over $150,000 in bear tag fees from 26,753 hunters in 1984 (ODFW files). Black bears prefer forest edge habitat and mature forests for denning sites (Aney 1967, Lindzey 1976, Herrero 1977). With inundation of the Cougar Project site, a variety of habitats used by black bears were lost. The black bear was selected as a target species for this study because of recreational value, habitat requirements, and loss of habitat due to the project.

b. Habitat requirements

Black bears are primarily adapted to forest ecosystems and their edges and clearings (Herrero 1977). Their preferred habitat is forest with numerous openings, glades, and edges (Aney 1967, Herrero 1977). Important communities for black bears include subclimax and early successional brushfields, wet and dry meadows, riparian areas, and various mixed and pure stands of mast or fruit producing hardwoods (Lawrence 1977). Coniferous forest provides security for bears in the form of hiding cover, travel corridors, and bedding and denning sites (Lindzey 1976, Jonkel 1978). Observations made during studies in southwestern Oregon indicated 74% of bear sightings were in coniferous and Douglas-fir/broadleaf forests, 14% in clearcuts, and 8% in brushfields

(McCollum 1973). Early seral plant communities, such as clearcuts and natural openings provide concentrations of foods for bears (Lindzey 1976, Lindzey and Meslow 1977). Although bears are attracted to open areas as sources of food, they will not venture far from cover, and remain within 350 yards of the forest edge (McCollum 1973, Lawrence 1977). Riparian areas are important for bears, providing a variety of foods during all seasons, as well as serving as travel corridors (Lawrence 1977, Jonkel 1978). Black bear dens are often located at the base of standing trees or snags, in hollow trees, under windfalls, in caves, or underground (Lawrence 1977, Maser et al. 1981). Black bears are opportunistic feeders and will consume green vegetation, fruits, nuts, fungi, invertebrates, mammals, birds, fish, and carrion (Beebe and Johnson 1965, Ingles 1965, Herrero 1977, Lawrence 1977, Jonkel 1978).

C. History in the project area

The historical status of the black bear in Oregon has varied. Unrestricted or liberal hunting seasons and damage control characterized OSGC's management of black bears until the 1970's (Lindzey 1976; Ebert 1977, 1979). The Oregon bear population reached its highest level before 1940 and has gradually declined since then (Aney 1967). The Willamette Basin bear population was estimated at 14,000 in 1967 (Aney 1967). ODFW estimated 3,500 black bears occupied 3,700 square miles of habitat within Lane County in 1980 (ODFW files).

Information is not available on black bear populations in the project area prior to construction. In recent years black bearss have been consistently seen along the East Fork in closed canopy forests. Juvenile male bears have been sighted north of the affected area at Delta Campground and Nature Trail. Bears presumably used the South Fork McKenzie River prior to construction, since they currently use similar habitat downstream from Cougar Dam and along the mainstream McKenzie River.

d. Assessment of impact

Most of the affected area was available habitat for black bears prior to construction of the Cougar Project (Table 4). The quality of the 3,061 acres of habitat was given a rating of 7 (above average) for a value of 2,143 HU's. The river bottom provided a north-south travel corridor of protective cover and forage. An anadromous fish run on the South Fork and carrion were food sources for black bears. Habitat meeting the reproductive requirements of black bears was available within the affected area and human disturbance was minimal. The affected area was characterized by a contiguous stretch of old-growth forest and lacked a high diversity of cover types and open areas, which prevented assessment of a higher rating.

Following completion of the project, 1,146 acres of black bear habitat remained within the affected area (Table 4). Black bears probably avoided the area entirely due to the disruption of the habitat and high human disturbance. The habitat was therefore given a rating of 1 (low), which resulted in a value of 115 HU's. This was a reduction in value of 2,028 HU's from preconstruction.

Table 4. Balck Bear: Acres of Habitat available and loss, habitat ratings and habitat units at Cougar Project.

Cover Type	Pre-construction (1953)	Post-construction (1965)	Recent (1979)	Loss or gain (+ or -) Pre to Post-construction	Loss or gain (+ or -) Preconstruction torment
Temperature conifer forest, open	24	200	314	+175	+290
Temperature conifer forest, closed	460	80	326	-3Bo	-134
Temperature conifer forest, old-growth	1,876	289	289	-1,587	-1,587
Conifer-hardwood forest	4	7	20	+3	+16
Riparian shrub	18	5	22	-13	+4
Riparian hardwood	233	41	38	-192	-1%
Shrubland	246	233	2%	-13	+52
Grass-forb	59	249	83	+190	+24
Red alder	0	0	10	0	+10
Sand/gravel/ cobble	34	6	0	-28	-34
River	107	36	36	-71	-71
TOTAL ACRES	3,061	1,146	1,436	-1,915	-1,625
Habitat Rating	7	1	2		
HABITAT UNITS	2,143	115	287	-2,028	-1,856

By 1979, natural revegetation had slightly increased the acreage of available black bear habitat within the affected area to 1,436 acres, but it was still considered poor by the evaluation team and rated 2 (Table 4). Black bears probably use the closed-canopy and old-growth habitats while moving to and from adjacent areas. The recent black bear habitat value of 287 HU's, was a loss of 1,856 HU's from the pre-construction value. The decline in HU's for black bear represents a loss in the potential of the project area to support bear and other wildlife species with similar habitat requirements.

Dam construction in the Pacific Northwest is almost always detrimental to black bear populations, resulting in the loss of both food and cover (Lawrence 1977). Riparian habitat, which provided a variety of foods and served as a travel corridor for bear, was eliminated, and anadromous fish runs, a source of food for bear populations were eliminated. Relocated roads adjacent to Cougar Reservoir receive logging traffic and provide access to the site for recreationists, resulting in increased disturbance and hunting pressure.

4. Cougar

a. Importance

The cougar has had an important place in wildlife management in Oregon as both a predator and big game species. Cougars have been managed on a bounty basis, but more recently have attained trophy status. In 1984, 167 hunters applied for the 15 permits available in the McKenzie Wildlife Management Unit for the 1984-85 season. Cougars are also important because of their interrelationship with deer and elk, which are primary prey species (Seton 1953, Ingles 1965, Hornocker 1970, Russell 1978). Cougars may be a factor in deer and elk dispersal on winter ranges (Hornocker 1970). The cougar was selected as a target species to represent a large carnivore and because of recreational value, low tolerance of human activity, and the impact of the project on the habitat of cougars and their prey.

b. Habitat requirements

Cougars in Oregon are associated with rough, mountainous terrain and forests with abundant deer populations (Aney 1967, Russell 1978). Some of the highest densities of cougars in Oregon occur in the southern portion of the McKenzie Wildlife Management Unit where the predominate habitat type is Douglas-fir/trailing blackberry with clearcut units surrounded by old-growth forests (Harcombe 1976). Cougars prefer primitive habitat where human activity is minimal or absent (Young and Goldman 1946, Aney 1967, Russell 1978). In Lane County cougars are found in the foothills near settled areas where prey is abundant (R. Carleson, R. Jubber, ODFW, pers. communs). Cougars generally bed under cover of rock, in caves, or in hollow trees (Seton 1953, Russell 1978). Females seek concealment in a secure location such as rocky depressions, shallow caves, rock overhangs, uprooted trees, or dense thickets for parturition (Russell 1978, Maser et al. 1981). Trees, steep bluffs, and caves provide cover (Hornocker 1970).

Old-growth forest and clearcut areas which support populations of black-tailed deer and Roosevelt elk provide good habitat for cougar. Old-growth forest is important hunting habitat for cougars (Hornocker 1970, Harcombe 1976). Winter observations by Harcombe (1976) indicated cougars remained in the vicinity of old-growth timber and seldom ventured through expanses of second-growth Douglas-fir. Several cougar sightings in Lane County have been in 0- to 15-year-old clearcut units within 1/2 mile of mature forest where the cougars were observed hunting or guarding a kill (R. Jubber, ODFW, pers. commun.). Deer and elk comprise the major portion of the cougar diet, and deer are considered their dietary staple (Ingles 1965, Hornocker 1970, Toweill and Meslow 1977, Russell 1978). Small mammals also comprise part of the cougar diet (Ingles 1965, Toweill and Meslow 1977).

C. History in the project area

Historically, cougars were probably once present throughout the entire Willamette Basin, but their presence was not compatible with early settlement of the area (Young and Goldman 1946, Aney 1967). As a result, the statewide cougar population declined until the late 1960's. In 1968 the cougar was declared a game animal and harvest was limited to damage control situations (Harcombe 1976). In 1970, the first cougar tags were issued for a recreational harvest season (Harcombe 1976).

Harcombe (1976) estimated a cougar population of 114 in the McKenzie Unit in 1976. Estimates made in 1980 for Lane County included 3,700 square miles of cougar habitat and a population of 310 cougars (ODFW files). Cougar sightings are reported every summer outside the affected area along the East Fork to Quaking Aspen Swamp. Cougars are seen occasionally along the ridgeline on private land to the west of the reservoir and north of the affected area. A pair of adult cougars were sighted within the affected area on the rocky outcrop above the east side of the dam in December 1984. An adult cougar was observed by local residents at least 5 times below Cougar Dam between January and March 1985 (L. Agpaoa, USFS, pers. commun.).

d. Assessment of impact

Cougars were assumed to have available the same vegetation cover types as deer and elk, their primary prey. The interagency evaluation team rated the 2,920 acres of cougar habitat available prior to project construction 6 (above average) for a value of 1,752 HU's (Table 5). Winter use of the area by deer and elk increased the value of the site for cougars, which probably followed deer and elk herds down the East Fork and Walker Creek drainages into the affected area. Disturbance attributed to the unimproved road along the river was considered minimal. The expanse of old-growth forest and lack of habitat diversity reduced the value of the area for deer and therefore for cougar.

Upon completion of the project, 1,104 acres of habitat were available for cougars within the affected area. The concentration of human activity at the project site probably caused cougars to avoid the area during construction and for several years following completion. The evaluation team rated the habitat 1 (low), for a value of 110 HU's, a reduction of 1,642 HU's from the preconstruction value.

Table 5. Cougar: Acres of habitat mailable and lost, habitat ratings, and habitat units at Cougar Project.

Cover Type	Pre-construction (1953)	Post-constructin (1965)	Recent (1979)	Loss or gain (+ or -) Pre to Post-construction	Loss or gain (+ or -) Preconstruction to recent
Temperate conifer forest, open	24	200	314	+176	+290
Temperate conifer forest, closed	460	80	326	-380	-134
Temperate conifer forest, old-growth	1,876	289	289	-1,587	-1,587
Conifer-hardwood forest	4	7	20	+3	+16
Riparian shrub	18	5	22	-13	+4
Riparian hardwood	233	41	38	-192	-1%
Shrubland	246	233	2%	-13	+52
Grass-for%	59	249	83	+190	+24
Red Alder	0	0	10	0	+10
TOAL ACRES	2,920	1,104	1,400	-1,816	-1,520
Habitat Rating	6	1	2		
HABITAT WITS	1,752	110	280	-1,642	-1,472

Cougar habitat available in 1979 totaled 1,400 acres. The evaluation team considered the habitat to be of poor quality for cougars, and rated the habitat 2 for a value of 280 HU's. This was a loss of 1,472 HU's from the preconstruction situation. The decline in HU's for cougar represents a loss in the potential of the project area to support cougar and other wildife species with similar habitat requirements. Cougars follow deer onto their winter range, but the affected area lacks winter thermal cover and maintenance forage needed by deer. Increased road traffic and human disturbance has a negative impact on both cougars and their prey. Trappers report cougar activity along the South Fork upstream of the project area, but the affected area is probably used by cougars only when they move to and from adjacent areas.

5. River otter

a. Importance

Furbearers documented as using the reservoir site prior to project construction included river otter, beaver, mink, raccoon, gray fox and skunk (USFWS 1959). The river otter was selected as a target species for this study because of its economic and recreational value, dependence on aquatic and riparian habitat, loss of habitat as a result of the Cougar Project, and to represent other species with similar habitat requirements.

b. Habitat requirements

The river otter is a semiaquatic mamnal dependent upon water and its associated riparian habitat for food, cover, and reproduction (LaDue 1935, Mace 1979, Deems and Pursley 1983). River otters use streams and mountain rivers ranging from 3-33 yards wide (Maser et al. 1981, Melquist and Hornocker 1983). During winter, otters seek fast-flowing streams free of ice (Mace 1979). Mudflats, open marshes and swamps, and backwater sloughs are used more often by otters during the summer months (Melquist and Hornocker 1983).

River otters use abandoned burrows of other animals as den sites (Mace 1979, Rue 1981, Toweill and Tabor 1982). Beaver houses or dens are used most often. Otter also use muskrat houses and dens, nutria dens, and marmot burrows located near water (Mace 1979, Rue 1981, Toweill and Tabor 1982). These dens are usually renovated and enlarged by the otter (Ingles 1965, Maser et al. 1981). Dens selected by river otters may be as far as 1/2 mile from water (Maser et al. 1981, USFS 1981a). Parturition may occur in dens or cavities among roots of trees, brushpiles, thickets of vegetation, under streambanks, or in hollow stumps or logs (Liers 1951, Mace 1979).

Principal food of the river otter is fish (Rue 1981, Toweill and Tabor 1982, Deems and Pursley 1983). They are opportunistic feeders, and select those fish species most abundant and/or easiest to catch (Toweill and Tabor 1982, Melquist and Hornocker 1983). Crayfish are an important year-round item in the otter diet (Maser et al. 1981, Toweill and Tabor

1982, Deems and Pursley 1983). In addition to fish and crayfish, the river otter diet includes amphibians, aquatic insects, small mammals, birds and eggs, and carrion. River otters also eat some vegetation such as berries, tubers, pondweeds, algae, and grasses (Sheldon and Toll 1964, Maser et al. 1981, Rue 1981, Toweill and Tabor 1982).

C. History in the project area

River otters formerly occupied nearly all permanent streams and lakes in Oregon (Mace 1979). Unregulated trapping was permitted until 1913, at which time the Oregon Legislature enacted comprehensive trapping laws for 5 species of furbearers, including river otter (Mace 1979).

River otters still occupy much of their original range but in lesser numbers due to reduced habitat and increased trapping pressure (Aney 1967, Mace 1979). In 1967, the river otter population was low in the Willamette Basin, with an estimated population of 500 animals (Aney 1967). In 1980 the estimated otter population in Line County was 850 animals over 985 linear stream miles (985 square miles) of habitat (ODFW) files). The population for the McKenzie River in 1982 was an estimated 153 animals over 255 river miles, for an average of 0.6 otter per mile (ODFW files). About 15-20 river otters have been harvested annually along the McKenzie River in the past few years (J. Greer, ODFW, pers. commun.). Quantitative information on river otter populations in the project area prior to construction was not available.

d. Assessment of impact

The habitat evaluation team assumed the conifer-hardwood, riparian shrub, riparian hardwood, sand/gravel/cobble, and river cover types were available to river otters in the affected area (Table 6), representing 396 acres of river otter habitat prior to project construction. This habitat was given a suitability rating of 6 (above average) for year-round use. Food was adequate and supplied by spring chinook smolts, Dolly Varden and cutthroat trout, and nongame fish. The habitat met reproductive requirements of river otters and human disturbance was minimal. The lack of slack water and a small salmonid population kept the value of the preconstruction habitat at no more than slightly above average. The 396 acres of habitat were therefore determined to equal 238 HU's.

Following completion of the project, 223 acres of habitat were available to river otters. This included 10% of the reservoir area used for foraging, primarily within the tributaries and at the upper end of the reservoir. The largest loss of habitat was from riparian hardwood and river cover types. The suitability of the remaining habitat was rated 1 (low) by the evaluation team. Disturbance of the area had recently occurred and vegetation had not yet begun to recover. The dam and reservoir inhibited river otter movement along the South Fork. The value of the postconstruction otter habitat within the affected area was 22 HU's, a loss of 216 HU's from the preconstruction value.

As a result of natural revegetation, available river otter habitat in the affected area totaled 244 acres by 1979. The value of the habitat

Table 6. River Otter: Acres of habitat availabel and lost, habitat ratings, and habitat units at Cougar Project.

Cover Type	Pre-construction (1953)	Post-construction (1965)	Recent (1979)	Loss or gain (+ or -) Pre- to Post-construction	Loss or gain (+ or -) Preconstruction to recent
Conifer-hardwood forest	4	7	20	+3	+16
Riparian shrub	18	5	22	-13	4
Riparian hardwood	233	41	38	-192	-195
sand/gravel/ cobble	34	6	0	-28	-34
River	107	36	36	-71	-71
Reservoir*	0	128	128	+128	+128
TOTAL ACRES	3%	223	244	-173	-152
HabitatRating	6	1	2		
HABITAT UNITS	238	22	49	-216	-189

*Represents 10% of reservoir area.

was rated 2 by the evaluation team, still poor but slightly improved over postconstruction conditions. Stocked trout and crayfish probably provided an adequate food supply, but the exposed reservoir shoreline did not provide adequate cover or denning sites. Human activity had a negative effect on river otters, which was probably increased by the lack of cover in the reservoir area. The 1979 river otter habitat was valued at 49 HU's, a loss of 189 HU's from the preconstruction value. The decline in HU's for river otter represents a loss in the potential of the project area to support otter and other wildlife species with similar habitat requirements.

USFWS (1959) predicted the reservoir shoreline would receive limited use by river otters, and fluctuating water levels below the dam would create "unfavorable conditions" for furbearers in that area. Research conducted in Idaho indicated Cascade Reservoir was virtually unused by river otters because there was insufficient escape cover and resting sites along the exposed shoreline even though there was a sufficient food source (Melquist and Hornocker 1983). This study also indicated that otters' tolerance of human activity was related to the amount of escape cover and shelter along a lake shoreline. The study concluded that stream-related habitats were preferred to lakes, reservoirs and ponds because of the availability of shelter and escape cover and less disturbance.

Relocated roads adjacent to Cougar Reservoir receive logging traffic and provide access to recreationists. The effect on river otters may be direct mortality, or increased disturbance and thus lower quality habitat.

6. Beaver

a. Importance

Beaver have an important place in Oregon's history, so much so that the species was selected as the state animal. Fur trade attracted the first white men to the Oregon territory, and beaver are still of economic value today. Beaver are dependent upon a relatively stable source of water and its associated riparian habitat for survival, where they create ponds and pools used by many species of fish and wildlife for rearing, feeding, and resting. The beaver was selected as a target species for this assessment because of historic and economic value, dependence upon riparian habitats, loss of habitat due to the project, and to represent other wildlife species with similar habitat requirements.

b. Habitat requirements

Slow-flowing streams, small streams or lakes well wooded with deciduous trees, and some agricultural waterways and wetlands may be selected for colonization by beaver (Aney 1967, Mace 1979, Deems and Pursley 1983). A minimum of 0.5 miles of stream channel or 0.5 square miles of lake or marsh habitat must be available before an area is suitable for beaver colonization (Allen 1982). Beaver need a permanent and relatively stable water source (Allen 1982). Stream gradient, which may be the

most significant factor in determining suitability of riverine habitat for beaver, must be less than 15% (Allen 1982). Beaver construct dams to stabilize water depths (Shay 1978, Mace 1979) and to create ponds which provide cover, feeding, and reproductive requirements (Rue 1981, Allen 1982, Deems and Pursley 1983).

A deciduous tree and/or shrub canopy closure of 40-60% is an indication of optimum food availability for beaver (Allen 1982). For maximum suitability, the diameter at breast height (dbh) of trees should range from l-6 inches, and shrubs should be at least 6-l/2 feed tall (Allen 1982). Tree species used include aspen, willow, cottonwood, alder, red osier dogwood, birch, maple, cherry, and poplar (Townsend 1953, Mace 1979, Allen 1982). Beaver feed primarily on the bark and cambium layer of deciduous trees and shrubs, as well as the twigs and leaves. Small quantities of of Douglas-fir, western hemlock, and Scotch broom also appear in the beaver diet (Maser et al. 1981). The majority of foraging occurs within 330 feet of the water's edge, and may extend to distances of 660 feet (Allen 1982). Aquatic vegetation is preferred and herbaceous vegetation appears to be preferred over woody vegetation (Allen 1982). Sedge and water lily rhizomes are consumed during the summer (Seton 1953, Townsend 1953, Allen 1982).

Beaver construct dens which fulfill their cover and reproductive needs (Allen 1982). Three basic forms of dens are constructed by beaver: a standing lodge in open water, a bank lodge with a burrow into the bank, and a burrow into the bank without a lodge (Ingles 1965, Allen 1982)

C. History in the project area

Quantitative information on furbearer populations in the project area prior to construction was not available. The reservoir site supported beaver, otter, mink, raccoon, and gray fox. Beaver were harvested in the greatest number (USFWS 1959).

Historical records indicate the Willamette Basin supported large beaver populations when the earliest trappers and explorers arrived in the early 1800's (Aney 1967). Beaver trapping in Oregon was restricted by a statewide closure in 1899 and did not resume until 1951 (Kebbe 1960, Shay 1978). Beaver populations had become seriously depleted due to over-trapping and habitat losses (Kebbe 1960). In 1932, a program was begun to live-trap beaver from damage sites or areas of healthy populations and transfer them to suitable habitat in an effort to reestablish beaver in their historical habitat (Scheffer 1941, Kebbe 1960, Shay 1978). The Willamette Basin beaver population in 1967 was estimated at 10,000 (Aney 1967). In 1982, ODFW estimated for Line County beaver densities of 10 beaver per linear mile on rivers over 100 feet wide, 7 beaver per linear mile on streams 20-100 feet wide, and 5 beaver per linear mile on streams 8-20 feet wide (ODFW files).

d. Assessment of impact

Prior to inundation, 396 acres of conifer-hardwood, riparian shrub, riparian hardwood, sand/gravel/cobble, and river were available to beaver within the affected area (Table 7). The evaluation team rated

Table7. Beaver: Acres of habitat available and lost, habitat ratings, and habitat units at Cougar Project.

Cover Type	Pre-amstructicn (1953)	Post-construction (1965)	Recent (1979)	Loss or gain (+ or -) Pre- to Post-construction	Loss or gain (+ or -) Preconstruction to recent
Conifer-hardwood forest	4	7	20	+3	+16
Riparian shrub	18	5	22	-13	+4
Riparian hardwood	233	41	38	-192	-195
Red alder	0	0	10	0	+10
Sand/gravel/ cobble	34	6	0	-28	-34
River	107	36	36	-71	-71
Reservoir+	0	38	38	+38	+38
TOTAL ACRES	396	133	164	-263	-232
Habitat Rating	6	2	3		
HABITAT UNITS	233	27	49	-211	-189

*Represents 3% of the reservoir area.

the habitat 6 (above average) resulting in a value of 238 HU's. Although not optimum, the affected area provided adequate forage, with a high percentage of the riparian habitat in hardwoods and backwater areas associated with tributary streams. Rocky river banks were not good for denning, but woody material was available for lodge construction.

Upon completion of the project, beaver habitat was reduced to 133 acres. This included 38 acres of reservoir (3% of the full pool surface). Beaver use of the reservoir is low, limited primarily to tributaries (L. Agpaoa, USFS; J. Greer, ODFW, pers. communs.) Post-construction habitat was rated 2 (poor). Few hardwood species were available as forage and the area was recently disturbed. The dam may not have completely blocked beaver dispersal along the river, but it probably inhibited beaver movement along the river. The habitat was valued at 27 HU's, a loss of 211 HU's from the preconstruction value.

Natural revegetation increased the more recent (1979) available beaver habitat to 164 acres. This habitat was given a rating of 3, resulting in a value of 49 HU's. This represented a loss of 189 HU's from pre-construction to recent conditions. The reservoir was considered poor beaver habitat by the evaluation team. Lakes and reservoirs having extreme fluctuations in water level are considered unsuitable beaver habitat (Allen 1982). The tributaries and higher quality beaver habitat located below the dam increased the suitability rating. Overall, forage availability was only adequate, and the affected area did not provide many denning sites. The major impact of the project was the loss of riparian hardwoods, the major food source for beaver. The decline in HU's for beaver represents a loss in the potential of the project area to support beaver and other wildlife species with similar habitat requirements, and species which use the ponds and pools created by beaver.

7. Ruffed grouse

a. Importance

Upland game birds potentially affected by construction of the Cougar Project included ruffed grouse, blue grouse, mountain quail, and band-tailed pigeon. The ruffed grouse was chosen as a target species because of its recreational value, because of the impacts which occurred from the loss of riparian habitat as a result of the Cougar Project, and to represent other wildlife species with similar habitat requirements.

b. Habitat requirements

Thickets of alder, hawthorn, birch, maple, and other deciduous trees provide summer and fall habitat for ruffed grouse in Oregon (Masson and Mace 1974). Adjacent conifer stands are used for escape cover and winter shelter.

Spring, summer, and fall diets of ruffed grouse in Oregon consist of a wide variety of leaves, grasses, forbs, berries, and buds (Durbin 1979). The availability of a winter source of birch, alder, hazel, or aspen catkins may be the most important factor influencing the survival

of wintering ruffed grouse (Gullion 1966). In Oregon, Durbin (1979) reported that alder buds and catkins are probably the primary winter food. Black cottonwood (buds, twigs, catkins) and buttercup are the primary winter food items of ruffed grouse in western Washington (Brewer 1980).

Ruffed grouse chicks for the first 7-10 days primarily consume invertebrates (Johnsgard 1973), which are most available in mesic conditions such as found in riparian habitat. Ruffed grouse broods use semi-open areas characteristic of early stages of woodland succession (Sharp 1963). Small hardwoods, shrubs, berry bushes, and lush herbs provide habitat preferred by ruffed grouse broods (Bump et al. 1947). Once ruffed grouse chicks reach about 4 months of age, closed-canopy forests are suitable habitat (Chambers and Sharp 1958).

Drumming sites are an important reproductive requirement of ruffed grouse. Drumming habitat may be either deciduous or mixed forest adjacent to fields, clear-cuts, or regrowth areas (Brewer 1980). Adequate nesting habitat is another reproductive requirement of ruffed grouse. Hardwood stands or mixed hardwoods are the most frequently used forest types for nesting (Edminster 1947, Maxson 1978). Nest sites are most often at the base of large trees, but some are located at the base of stumps, logs, or bushes, usually within 50 feet of clearings or fields (Edminster 1947).

C. History in the project area

Grouse populations were "quite large" in the project area prior to project construction and supported most of the hunting pressure for upland game (USFWS 1959). Quantitative information on grouse populations in the project area prior to construction was not available. The OSGC estimated 4 grouse per square mile in the McKenzie watershed in 1948. In 1973, OSACE estimated a density of 150 ruffed grouse within a 1/2 mile radius of Cougar Reservoir (USACE 1973).

d. Assessment of impact

Riparian hardwood, shrubland, and closed conifer forest cover types comprised the majority of the 1,044 acres evaluated as ruffed grouse habitat prior to project construction (Table 8). The suitability of this habitat was rated 6 (above average) and was limited primarily by the narrow stream corridor and the steep slopes with shallow soils. The relative value of the affected area for ruffed grouse prior to construction was 626 HU's.

Construction of the project resulted in the immediate loss of 229 acres of ruffed grouse habitat, including 205 acres of riparian habitat (Table 8). Revegetation and successional changes from the postconstruction period to the recent period resulted in a net gain of 67 acres of ruffed grouse habitat, most of which was due to increases in the marginal value habitat provided by conifer forests. Evaluation of recent (1979) conditions in the project area indicated a rating of 3 for the 1,111 acres of habitat available at that time (Table 8). Lack of riparian habitat, a large amount of conifer forest, and lack of forest

Table 8. Ruffed Grouse: Acres of Habitat available and lost, habitat ratings, and habitat units at Cougar Project.

Cover Type	Pre-construction (1953)	Post-construction (1965)	Recent (1979)	Loss or gain (+ or -) Pre- to Post-construction	Loss or gain (+ or -) Precosntruction to recent
Temperate conifer forest, open	24	200	314	+176	+290
Temperate conifer forest, closed	460	80	326	-380	-134
Conifer-hardwood forest	4	7	20	+3	+16
Riparian shrub	18	5	22	-13	+4
Riparian hardwood	233	41	38	-192	-195
Shrubland	246	233	298	-13	+52
Grass-fall	59	249	83	+190	+24
Red alder	0	0	10	0	+10
TOTAL ACRES	1,044	815	1,111	-229	+67
Habitat Rating	6	3	3		
HABITAT UNITS	626	245	333	-381	-293

openings were given as reasons for the below average habitat rating. The 333 HU's calculated for the recent conditions represented a loss of 293 HU's from preconstruction conditions. The decline in HU's represents a loss in the potential of the project area to support ruffed grouse and other wildlife species with similar habitat requirements.

8. Waterfowl (Barrow's and common goldeneye, bufflehead, common merganser, harlequin)

a. Importance

Waterfowl were chosen as target species because of their high recreational value, their dependence on aquatic habitat, and the impacts which occurred as a result of the project. Year-round habitat suitability was evaluated for 4 species which use the project area for breeding, wintering, or resting during migration. The habitat requirements of the 4 species (Barrow's and common goldeneye, bufflehead, common merganser) in this group encompass many of the basic requirements of other waterfowl species which may use the project area (Appendix A). In addition, the breeding habitat for harlequin ducks was evaluated separately because of their different habitat requirements.

b. Habitat requirements

Swift streams and large lakes of the Cascade Mountains in Oregon provide either breeding or wintering habitat for several species of waterfowl. Among the species most likely to breed in the Cougar area are Barrow's goldeneye, common merganser, and harlequin. Barrow's goldeneyes are cavity nesters, preferring to nest within 100 feet of water but may nest as far as 1/2 mile from the nearest water (Bellrose 1976, Terres 1980). Tree species frequently containing suitable cavities include cottonwood and Douglas-fir. Nest sites are usually located near relatively shallow lakes and ponds with extensive beds of submerged aquatic and marsh vegetation. Deep lakes with barren margins support few breeding birds (Bellrose 1976). common mergansers typically nest in cavities also and prefer deciduous riparian habitat in later forest stages (USFS 1981b). Gabrielson and Jewett (1940) reported that common mergansers nested along swifter streams and shores of larger lakes throughout Oregon. Harlequins nest along rocky shores adjacent to turbulent mountain streams (Bellrose 1976), and will either nest on the ground or in holes in trees or cliffs (Gabrielson and Lincoln 1959). Brood habitat of harlequins consists of swift water with interspersed pools and riffles (Kuchel 1977).

Foods consumed by common mergansers include fish and fish eggs, aquatic invertebrates, frogs, newts, and some aquatic plants (Bellrose 1976, USFS 1981b). Common mergansers forage in clear water 1-1/2 to 6 feet deep and eat a wide variety of fishes depending upon the species' availability. The diet of Barrow's goldeneyes consists of approximately 78% animal matter (Cattam 1939) and includes aquatic insects, crayfish, snails, sculpins, and salmon eggs (Munro 1939, Terres 1980). Plant foods consumed by goldeneyes are primarily seeds and vegetative parts of pondweeds, and algae (Bellrose 1976). Animal food comprises almost the entire diet of harlequins. During the summer they feed on stoneflies, water boatmen, and midge larvae (Gabrielson and Lincoln 1959).

Waterfowl species occurring at Cougar Reservoir during winter include COMMON goldeneye, bufflehead, and common merganser. Bufflehead diets are similar to diets of Barrow's and common goldeneyes and are largely comprised of animal matter. During winter, snails and fish are important animal foods, while seeds of pondweeds and bulrushes are among the important plant foods (Erskine 1972).

C. History in the project area

Information was not available on waterfowl populations in the project area prior to construction. Harlequin ducks occur on fast-flowing streams in the general area around Cougar and probably used the South Fork McKenzie River in the project area prior to construction. Common mergansers also may have used the project area before project construction.

USFWS, USFS, and ODFW do not conduct waterfowl counts on Cougar Reservoir. According to usace (1973) a limited number of waterfowl use the reservoir for resting during migration. ODFW reported that Cougar Reservoir has low potential for waterfowl use because of the drawdown and filling periods (Denney 1982).

d. Assessment of impact

Year-round habitat suitability was rated for 4 waterfowl species which potentially used the project area (Barrow's and common goldeneye, bufflehead, and COMMON merganser). Harlequin ducks were rated separately because of their different habitat requirements. Harlequins winter along the coast, therefore, the value of the habitat at Cougar was assessed for breeding habitat only.

Habitat available to waterfowl (other than harlequins) prior to project construction consisted of 396 acres of conifer-hardwood forest, riparian shrub and hardwoods, sand/gravel/cobble, and river (Table 9). The suitability of this habitat for waterfowl was rated 1 (low). Rationale for the low rating included the relatively poor quality foraging, resting, and nesting habitat, and the fact that the project area is located well off major flyways. The relative value of preconstruction habitat was 40 HU's for waterfowl as a group (Table 9).

After construction of the Cougar Project, 1,375 acres of waterfowl habitat were available in the affected area. The increase in habitat was a result of the 1,280-acre reservoir, which primarily serves as a resting area for limited numbers of waterfowl during migration. Seventy-one acres of river habitat and 205 acres of riparian habitat used for foraging and nesting by waterfowl were lost (Table 9). The suitability of this habitat was rated 1 (low), for a HU value of 138.

By 1979, habitat available to waterfowl in the project area had increased to 1,396 acres. The lowest possible rating (1) was given, which resulted in a HU value of 140, or an increase of 100 HU's from preconstruction conditions (Table 9). The reservoir is not along a flyway and provides little foraging or nesting habitat because of its depth, steep shoreline, and fluctuating water levels. Therefore, it was

Table9. Waterfowl: Acres of habitat available and lost, habitat ratings, and habitat units at Cougar Project.

Cover Type	Pre-construction (1944)	Post-construction (1956)	Recent (1979)	Loss or gain (+ or -) Pre- to Post-construction	Loss or gain (+ or -) Preconstruction to recent
Conifer-hardwood forest	4	7	20	+3	+16
Riparian shrub	18	5	22	-13	+4
Riparian hardwood	233	41	38	-192	-195
Sand/gravel/ cobble	34	6	0	-28	-34
River	107	36	36	-71	-71
Reservoir	0	1,280	1,280	+1,280	+1,280
TOTAL ACRES	396	1,375	1,396	+979	+1,000
Habitat Rating	1	1	1		
HABITAT WITS	40	138	140	+98*	+100*

*Interagency evaluation team concluded there was no net gain of HU's for waterfowl - see text for explanation.

concluded by the interagency evaluation team that the project did not actually result in a net gain of HU's for waterfowl.

The suitability of the 396 acres of preconstruction habitat for harlequins was rated 8 (high) resulting in 317 HU's available (Table 10). Foraging, nesting, and roosting habitat conditions were near optimum. Some disturbance probably occurred from anglers and as a result of the road along the river.

Harlequin ducks experienced adverse impacts due to the loss of nesting and brood-rearing habitat associated with swift streams. Habitat available for harlequins was reduced to 95 acres after construction (Table 10). Lack of the fast-flowing stream and associated habitat and recent disturbance were contributing factors to the remaining habitat rating of 2 (poor) and a relative habitat value of 19 HU's. This was a loss of 298 HU's from preconstruction conditions (Table 9).

The 116 acres of habitat available to harlequins by 1979 was rated 3 (below average). The rating was higher than the postconstruction (1965) rating because the quality of the habitat for foraging and nesting had probably increased as the level of disturbance decreased and revegetation occurred. The loss of 282 HU's (Table 10) for harlequins in the affected area from preconstruction conditions to recent conditions is the equivalent of 282 acres of optimum harlequin habitat lost as a result of the project. The decline in HU's for harlequin ducks represents a loss in the potential of the project area to support harlequins and other wildlife species with similar habitat requirements.

9. Yellow warbler

a. Importance

The yellow warbler is on the USFWS (1982) list of sensitive bird species for Region One, which includes the project area. Although populations do not show significant changes in Oregon, they are declining throughout the region. The yellow warbler was chosen as a target species because of its use of riparian habitat, to represent other species with similar habitat requirements, and because of its sensitive status.

b. Habitat requirements

Preferred habitats of yellow warblers are wet areas with abundant shrubs or small deciduous trees (Hoffman 1927, Bent 1953). Nesting habitat is provided by deciduous shrubs and trees including willows, alders, and cottonwoods near streams. Coniferous areas and closed canopy forests are mostly avoided (Hoffman 1927, Schroeder 1982). Yellow warblers forage in deciduous shrubs and trees and primarily consume insects (Bent 1953, Schroeder 1982).

C. History in the project area

Information was not available on yellow warbler populations during the preconstruction period. The yellow warbler is considered a comnon species in Oregon (USFWS 1982). Breeding Bird Survey data collected throughout the region over 11 years do not indicate significant

Table 10. Harlequin Duck: Acres of habitat available and lost, habitat ratings, and habitat units at Cougar Project

Cover Type	Pre-construction (1953)	Post-construction (1965)	Recent (1979)	Loss or gain(+ or -) Pre- to Post-construction	Loss or gain(+ or -) Preconstruction to recent
Conifer-hardwood forest	4	7	20	+3	+16
Riparian shrub	18	5	22	-13	+4
Riparian hardwood	233	41	38	-192	-195
Sand/gravel/ cobble	34	6	0	-28	-34
River	107	36	36	-71	-71
TOTAL ACRES	3%	95	116	-301	-280
Habitat Ratings	8	2	3		
HABITAT UNITS	317	19	35	-298	-282

population changes in Oregon overall; however, population reductions have occurred in certain localities within the state (USFWS 1982).

d. Assessment of impact

Habitat available to yellow warblers prior to project construction consisted of 501 acres, most of which was shrubland and riparian vegetation (Table 11). Although these cover types are preferred by yellow warblers, the high elevation of the project area and the fragmented nature of the riparian habitat would preclude optimum use. A suitability rating of 6 (above average) was given for the preconstruction habitat conditions, resulting in 301 HU's available at that time.

After construction of the Cougar Project (1965), 286 acres of habitat were available, a loss of 215 acres. Most of the habitat lost was riparian hardwood and shrub. The suitability of the remaining habitat was rated 2 (poor) because the recent disturbance to the vegetation resulted in a relatively undeveloped shrub layer. Only 57 HU's were available at that time for yellow warblers, a loss of 244 HU's from preconstruction conditions.

By 1979, 438 acres of habitat were available. An increase in shrubland accounted for most of the habitat increase. The habitat was rated 3 (below average), resulting in 131 HU's available to yellow warblers, a loss of 170 HU's from preconstruction conditions. The decline in HU's represents a loss in the potential of the project area to support yellow warblers and other wildlife species with similar habitat requirements.

10. American dipper

a. Importance

The American dipper was chosen as a target species because of its dependence on free-flowing stream habitat and because of impacts which occurred as a result of the project.

b. Habitat requirements

Dippers inhabit fast-flowing mountain streams throughout western North America. Characteristics of nest sites vary with local habitat conditions but usually include proximity to water, location above high water, inaccessibility to terrestrial predators, and location on a horizontal ledge or crevice for support (Sullivan 1973). Nests are often placed among rocks or behind waterfalls (Gabrielson and Jewett 1940). Escape cover is provided by logs, streamside vegetation, or the water in the stream (Sullivan 1965).

Dippers ordinarily forage in riffles and faster waters 1/2-2 feet deep where many of the favored foods are concentrated (Bakus 1959). Aquatic insect larvae are a major food source; terrestrial and flying insects, amphibians, and fish are consumed less frequently (Bakus 1959, Thut 1970, Sullivan 1973).

Table 11. Yellow Warbler: Acres of habitat available and lost, habitat ratings, and habitat units at Cougar Project.

Cover Type	Pre-construction (1953)	Post-construction (1965)	Recent (1979)	Loss or gain (+ or -) Pre- to Post-construction	Loss or gain (+ or -) Preconstruction to recent
Conifer hardwood forest	4	7	20	+3	+16
Riparian shrub	18	5	22	-13	+4
Riparian hardwood	233	41	38	-192	-1%
Shrubland	246	233	298	-13	+52
Grass-forb	0	0	50*	0	+50
Red alder	0	0	10	0	+10
TOTAL ACRES	501	286	438	-215	-63
Habitat Rating	6	2	3		
HABITAT UNITS	301	57	131	-244	-170

*50 acres of grass-forb cover type were considered to be potential habitat because of location relative to other cover types used by warblers.

C. History in the project area

Information was not available on populations of dippers during the preconstruction period. It may be assumed, however, that because river and stream habitats were more plentiful in the project area, dipper populations were larger prior to project construction than they are now.

d. Assessment of impact

Prior to construction of the Cougar Project, 392 acres of available habitat existed for dippers in the project area (Table 12). The suitability of the habitat was rated 8 (high), because of the contiguous stream and bank habitat available on the main river (6.5 miles) and tributaries, which provided the requirements for dipper foraging, cover, and reproduction. The preconstruction habitat value was 314 HU's.

Construction of the project resulted in a reduction of 296 acres of available habitat from preconstruction conditions to 1979. Greatest losses occurred in the riparian hardwood and river cover types (Table 12). The remaining 96 acres were assigned a habitat suitability rating of 3. Rationale for the below average rating included the limited amount of nesting and foraging habitat available. As a net result of the project, 285 HU's for dippers were lost. The decline in HU's for American dippers represents a loss in the potential of the project area to support dippers and other species which use river and stream habitat.

11. Pileated woodpecker

a. Importance

The pileated woodpecker is a primary cavity excavator. Vacated woodpecker cavities are used by many birds and mamnals for reproduction, roosting, shelter, or hibernation (Bull and Meslow 1977). The pileated woodpecker was chosen as a target species because of its preference for old-growth and mature forest habitat, to represent species which use those cover types, and because of the degree of impacts which occurred as a result of the project.

b. Habitat requirements

Pileated woodpeckers in western Oregon find optimum habitat for nesting and foraging in old-growth Douglas-fir forests (Meslow et al. 1981). Pileated woodpeckers also nest in true fir and decidous trees (Bent 1964, Conner et al. 1975). Critical habitat components are large snags, large trees, diseased trees, dense forest stands, and high snag densities (Bull 1975). Pileated woodpeckers prefer to nest in 2-storied stands with a crown closure of approximately 70% and in trees or snags with a dbh greater than 20 inches (Bull 1975, Bull and Meslow 1977, Schroeder 1983).

Foraging habitats of pileated woodpeckers contain high densities of logs and snags, dense canopies, and tall shrub cover. Carpenter ants and

Table 12. American Dipper: Acres of habitat available and lost, habitat ratings, and habitat units at Cougar Project.

Cover Type	Pre-construction (1953)	Post-construction (1965)	Recent (1979)	Loss or gain (+ or -) Pre- to Post-construction	Loss or gain (+ or -) Preconstruction to recent
Riparian shrub	18	5	22	-13	+4
Riparian hardwood	233	41	38	-192	-1%
Sand/gravel/ cobble	34	6	0	-28	-34
River	107	36	36	-71	-71
TOTAL ACRES	392	88	96	-304	-2%
Habitat Rating	8	2	3		
HABITAT UNITS	314	18	29	-2%	-285

their larvae, and other wood-boring insects are the primary food items of pileated woodpeckers (Bull 1975).

C. History in the project area

Information was not available on populations of pileated woodpeckers during the preconstruction period. It may be assumed, however, that because old-growth forests were more plentiful in the project area prior to project construction, pileated woodpecker populations were larger than they are now.

d. Assessment of impact

The project area prior to construction contained an estimated 2,597 acres of habitat available to pileated woodpeckers. The combination of old-growth forests (1,876 acres), riparian hardwoods, and mature second-growth conifer forests made conditions nearly ideal and resulted in a habitat suitability rating of 9 (high) (Table 13).

After construction of the Cougar Project (1965) 617 acres of habitat were available, a loss of 1,980 acres of high quality habitat. The remaining habitat was rated 3 (below average) based on the recent habitat disturbance, human disturbance, and limited amount of nesting habitat (417 acres) available. Over 2,000 acres of potential nesting habitat were lost. The overall loss was 2,152 HU's from preconstruction conditions.

The amount of habitat available to pileated woodpeckers in 1979 was 997 acres. The suitability of this habitat was rated 4 (below average) (Table 13). Foraging habitat quality was considered slightly above average because of the amount of down logs available. Small areas of available nesting habitat and the potential for human disturbance prevented assessment of a higher rating. The 399 HU's available to pileated woodpeckers in 1979 represent a loss of 1,938 HU's from the 2,337 HU's present prior to construction. The decline in HU's for pileated woodpeckers represents a loss in the potential of the project area to support woodpeckers and other wildlife with similar habitat requirements.

12. Northern spotted owl

a. Importance

The northern spotted owl is currently classified by ODFW as "threatened" in Oregon. Populations in Oregon appear to be declining as old-growth conifer forests are gradually eliminated (Forsman et al. 1985). The spotted owl is frequently used as an indicator species in the Pacific Northwest because it is sensitive to land use actions affecting old-growth forests. The spotted owl was chosen as a target species because of its threatened status, management emphasis within Oregon, because of its dependence on old-growth forests, and to represent the group of species which find optimum habitat in old-growth forests.

Table 13. Pileated Woodpecker: Acres of habitat available and lost, habitat ratings, and habitat units at Cougar project.

Cover Type	Pre-construction (1953)	Post-construction (1965)	Recent (1979)	Loss or gain (+ or -) Pre- to Post-construction	Loss or gain (+ or -) Preconstruction to recent
Temperate conifer forest, open	24	200	314	+176	+290
Temperate conifer forest, closed	460	80	326	-380	-134
Temperate conifer forest, old-growth	1,876	289	289	-1,587	-1,587
Conifer-hardwood forest	4	7	20	+3	+16
Riparian hardwood	233	41	38	-192	-1%
Red alder	0	0	10	0	+10
TOTAL ACRES	2,587	617	997	-1,980	-1,QO
Habitat Rating	9	3	4		
HABITAT UNITS	2,337	185	399	-2,162	-1,938

b. Habitat requirements

Recent studies in western Oregon identified old-growth forests as required habitat for spotted owls (Forsman et al. 1977, 1984). Ninety-eight percent of the pairs located by Forsman et al. (1984) were found in unlogged old-growth forests (>200 years old) or in mixed forests of old-growth and mature timber. Nesting habitat is provided by multi-layered (uneven-aged) old-growth forests. Most spotted owl nests in western Oregon are located in cavities in old-growth conifers; others occur on platforms in mature or old-growth conifers (Forsman et al. 1984). Nests are typically found within 1,000 feet of a spring or small stream. Spotted owls also prefer old-growth forests for roosting (more than 90% of the time), because these forests provide protection under most weather conditions (Forsman et al. 1984).

Radio-tagged owls on the west slope of the Cascade Mountains show a strong preference for foraging in unlogged old-growth forests (Forsman et al. 1984). Second-growth forests older than 25-35 years of age provide marginal foraging habitat. The diet of spotted owls varies seasonally, with a variety of mammals, birds, and insects consumed. Mammals comprise 92% of all prey taken (Forsman et al. 1984). During fall and winter the primary prey of spotted owls in forests of Douglas-fir and western hemlock are northern flying squirrels. During spring and summer snowshoe hares, shrews, pocket gophers, red tree voles, western red-backed voles, small birds, and insects become increasingly common in the diet (Forsman et al. 1984).

C. History in the project area

Spotted owls were historically thought to be uncommon or rare throughout their range because they inhabit dense forests and were seldom observed (Forsman et al. 1985). Prior to the late 1960's, techniques did not exist which allowed the collection of reliable population data (Forsman et al. 1984). It may be assumed, however, that historically the acreage of old-growth forests was greater and consequently spotted owl populations were larger than they are now. Two proposed spotted owl management areas (SOMA's) currently exist near Cougar Reservoir.

d. Assessment of impact

Habitat available to spotted owls in the affected area prior to project construction consisted of 2,360 acres, 1,876 acres of which were old-growth conifer forest (Table 14). The suitability of the habitat for spotted owls was assessed a value of 8 (high), yielding 1,888 HU's. The contiguous acres of old-growth forest provided food, cover, and breeding requirements. The steepness of the terrain, however, may have reduced the quality of the habitat. The interagency evaluation group estimated that the affected area had the potential to support at least 4 pairs of spotted owls.

Construction of the Cougar Project resulted in the loss of 1,587 acres of old-growth forest (Table 14). The remaining fragmented habitat could not support spotted owls; however, spotted owls from adjacent old-growth areas may use portions of the remaining habitat for foraging. The roads

Table 14. Northern Spotted Owl: Acres of habitat available and lost, habitat ratings, and habitat units at Cougar Project.

Cover Type	Pre-construction (1953)	Post-construction (1965)	Recent (1979)	Loss or gain (+ or -) Pre- to Post-construction	Loss or gain (+ or -) Preconstruction to recent
Temperate conifer forest, open	24	200	200	+176	+176
Temperate conifer forest, closed	460	80	80	-380	-380
Temperate conifer forest, old-growth	1,876	289	289	-1,937	-1,937
TOTAL ACRES	2,360	569	569	-1,791	-1,791
Habitat Rating	8	2	2		
HABITAT UNITS	1,888	114	114	-1,774	-1,774

surrounding the reservoir and human disturbance further reduce the value of the habitat. The suitability of the remaining habitat was rated 2 (poor) and valued at 114 HU's (Table 14). Construction of the Cougar Project resulted in the loss of 1,774 HU's, equivalent to 1,774 acres of optimum spotted owl habitat. The decline in HU's for northern spotted owls represents a loss in the potential of the project area to support spotted owls and other wildlife species with similar habitat preferences or requirements.

In addition to the loss of habitat, the presence of Cougar Reservoir may inhibit movement of spotted owls in the area. Forsman et al. (1984) reported that owls with home ranges adjacent to Blue River Reservoir rarely crossed the reservoir except at the upper end where it is less than 164 yards wide. The reservoir may prevent owls in the area from extending their home ranges, which could be necessary for their survival if adjacent old-growth forests are logged and no longer available as habitat.

13. Bald eagle

a. Importance

The bald eagle is classified by ODFW and USFWS as "threatened" in Oregon. The Pacific States Bald Eagle Recovery Team (1982) set recovery goals for bald eagle populations in Oregon and identified Cougar Reservoir as a potential nesting area. Potential nesting areas were determined by historical nest records, occasional sightings of adult eagles, and/or presence of old-growth forests within 1 mile of a water body possessing a good supply of fish and/or waterfowl. The bald eagle was chosen as a target species because of its threatened status, management emphasis within Oregon and specifically at Cougar Reservoir, and because bald eagles may have benefited from the construction of the Cougar Project.

b. Habitat requirements

Bald eagles find optimum nesting and roosting habitat in old-growth forests (Meslow et al. 1981). In western Oregon, Douglas-fir is the most frequently used tree species for nesting (Anthony et al. 1982). Tree structure and uneven-aged forest stands appear to be more important, however, than tree species in the selection of nest trees. Nest trees are typically the largest tree in the stand and are usually located within 1 mile of large bodies of water (Anthony et al. 1982). Winter roosting sites are characterized by a protected microclimate, stout perches high above the ground, a clear view of surrounding terrain, and freedom from human activity (Hansen et al. in Stalmaster et al. 1985). Bald eagles use both deciduous roosts in riparian habitat and coniferous roosts for protection from adverse weather (Stalmaster and Newman 1979). Bald eagles use mature or old-growth roost trees that are larger than the average size of surrounding trees (Hansen et al. 1980, Keister 1981, Anthony et al. 1982).

Bald eagles forage in open areas, usually associated with rivers, lakes, or coastal shorelines (Stalmaster et al. 1985). The Pacific States Bald

Eagle Recovery Team (1982) stated that food supply is probably the most critical component of bald eagle wintering habitat in the Pacific Region. The most common foods of eagles in this region include fish, waterfowl, and carrion. Anadromous fish, trout, whitefish, squawfish, carp, suckers, and tui chubs are used by eagles (Pacific States Bald Eagle Recovery Team 1982). Waterfowl are an important food item for the Klamath Basin (Keister 1981) and at some reservoirs on the Columbia River (Fielder 1982). Studies in Washington (Servheen 1975, Stalmaster 1976) identified mammalian carrion as an important alternate food source. Because the young are less tolerant of food deprivation than adults, a constant food supply is most important during the nesting season (Stalmaster et al. 1985).

Perching sites are another important feature of bald eagle habitat. Proximity to food is the primary factor governing selection of perching sites (Steenhof et al. 1980). Preferred perching sites are on the edge of stands and include the tallest trees with strong, lateral branches high in the crown (Stalmaster et al. 1985). Perches may also be used as "sentry" sites by breeding adults for defending the nest. Snags are preferred perching sites in winter, and when near the nest tree, are preferred perching locations during the nesting season (Stalmaster and Newman 1979, Forbis et al. in Stalmaster et al. 1985).

C. History in the project area

Information is not available on the status of bald eagle populations in the project area prior to construction. Estimates in 1973 indicated there were 2 bald eagles within a 1/2-miles radius of Cougar Reservoir (USACE 1973). No nests have been located in the reservoir area (Isaacs an Anthony 1983), although Cougar Reservoir is listed as a potential nesting area and a pair are believed to be nesting nearby (L. Agpaoa, USFS, pers. commun.). Juveniles were observed during the 1984 nesting season. A pair of adults and an undetermined number of juveniles currently winter in the reservoir area.

d. Assessment of impact

Prior to project construction the affected area contained 2,738 acres of bald eagle habitat (Table 15). Most of this acreage was old-growth forest, which provided potential nesting and roosting sites. The 6.5 miles of river and the tributaries provided a limited prey base. The suitability of this habitat was rated 3 (below average) for bald eagles, indicating 821 HU's were available prior to project construction.

Construction of the Cougar Project resulted in the loss of 2,004 acres of terrestrial habitat used by bald eagles for nesting and perching. The project created an additional 1,209 acres of aquatic habitat used by bald eagles for foraging. The quality of foraging habitat at Cougar Reservoir is less than optimum; however, the present fish populations may provide a more stable food source than existed prior to construction. Increased human access resulting from the project may cause disturbance to feeding, nesting, or roosting bald eagles. The suitability of the habitat both directly after completion of the project

Table 15. Bald Eagle: Acres of habitat available and lost, habitat ratings, and habitat units at Cougar Project.

Cover Type	Pre-construction (1944)	Post-construction (1956)	Recent (1979)	Loss or gain (+ or -) Pre- to Post-construction	Loss or gain (+ or -) Preconstruction to recent
Temperate conifer forest, open	24	zoo	200	+176	+176
Temperate conifer forest, closed	460	80	80	-380	-380
Temperate conifer forest, old-growth	1,876	289	289	-1,587	-1,587
Conifer-hardwood forest	4	7	20	+3	+16
Riparian hardwood	233	41	38	-IQ	-1%
Sand/gravel/ cobble	34	6	0	-28	-34
River	107	36	36	-71	-71
Reservoir	0	1,280	1,280	+1,280	+1,280
TOTAL ACRES	2,738	1,939	1,943	-799	-7%
Habitat Rating	3	6	6		
HABITAT UNITS	821	1,163	1,166	+342	+345

(1965) and in 1979 was rated 6 (above average) for bald eagles. By 1979, 1,943 acres of bald eagle habitat were present in the affected area and the relative value of that habitat was 1,166 HU's (Table 15). From preconstruction conditions to 1979. 345 HU's were gained as a result of the project.

14. Osprey

a. Importance

The osprey is included on the USFWS 1982 list of national species of special emphasis and was chosen as a target species because of management interest within Oregon, and because this species may have benefited from the construction of the Cougar Project.

b. Habitat requirements

Ospreys inhabit mid- to late-stage forests near lakes or large rivers. Nests are usually located within a mile of water (Koplin 1971). Nests are most commonly on the top of partially or completely dead trees ranging in height from 50-250 feet (French and Koplin 1972). Lind (1976) reported an average height of 120 feet and average dbh of 43 inches for osprey nest trees adjacent to Crane Prairie Reservoir, Oregon. In addition to the nest tree, at least one other large tree within 150 yards is regularly used by the nesting pair and fledglings for sunning, protection from wind, and as a "lookout" perch and feeding post (Lind 1976, Zarn undated). Ospreys require open and clear water for foraging. Their diet is almost exclusively fish, generally 6-12 inches in length (Lind 1976).

C. History in the project area

The only information available on osprey populations during the preconstruction period was a study by Gullion (1951), in which the osprey was reported to be an uncommon summer resident of Lane County during the period 1938-48. In 1976, Henny et al. (1978) identified 1 nesting pair at Cougar Reservoir. There are currently 5 osprey nests near Cougar, 2 of which are active (L. Agpaoa, USFS, pers. commun.).

d. Assessment of impact

Osprey habitat within the affected area consisted of old-growth and the larger open and closed conifer forest stands, conifer-hardwood forest, riparian hardwood, sand/gravel/cobble, and river cover types. Prior to construction of the project, 2,738 acres of habitat were available to ospreys within the affected area (Table 16). The suitability of the habitat for ospreys during the breeding season was assessed as 5 (average) by the interagency evaluation group. Thus, 1,369 HU's were available to ospreys prior to construction. It was estimated that the area along the river could have supported up to 3 pairs of ospreys. The relatively narrow, steep canyon and the limited fish prey base were considered when rating the suitability of the preconstruction habitat.

Table 16. Osprey: Acres of habitat available and lost, habitat ratings, and habitat units at Cougar Project.

Cover Type	Pre-construction (1944)	Post-construction (1956)	Recent (1979)	Loss or gain (+ or -) Pre- to Post-construction	Loss or gain (+ or -) Preconstruction to recent
Temperate conifer forest, open	24	200	200	+176	+176
Temperate conifer forest, closed	460	al	80	-380	-380
Temperate conifer forest, old-growth	1,876	289	289	-1,587	-1,587
Conifer-hardwood forest	4	7	20	+3	+16
Riparian hardwood	233	41	38	-192	-1%
Sand/gravel/ cobble	34	6	0	-28	-34
River	107	36	36	-71	-71
Reservoir	0	1,280	1,280	+1,280	+1,280
TOTAL ACRES	2,738	1,939	1,943	-7%	-7%
Habitat Rating	5	8	8		
HABITAT UNITS	1,369	1,551	1,554	+182	+185

Construction of the Cougar Project resulted in a loss of 2,004 acres of terrestrial habitat available to ospreys for nesting and perching. The project created an additional 1,209 acres of aquatic habitat which could be used by ospreys for foraging. Cougar Reservoir probably benefited osprey populations in the project area by creating this additional foraging habitat, although forage is less than optimum. The project has resulted in increased human access and disturbance which may adversely affect nesting success. By 1979, 1,943 acres of habitat were available to ospreys. The suitability of the habitat was rated 8 (high), resulting in 1,554 HU's (Table 14). This would indicate that 185 HU's were gained for ospreys as a result of the project.

v. SUMMAR

The Cougar Project inundated, extensively altered, or affected 3,096 acres of land and river in the McKenzie River drainage. Impacts to wildlife centered around the loss of 1,587 acres of old-growth forest and 195 acres of riparian hardwoods. Thirteen cover types were identified within the area directly affected by construction and operation of the hydroelectric-related components of the project. Acreages of each cover type were calculated for 3 time periods: prior to project construction (1953), directly after construction (1965), and more recently (1979) (Table 1).

Project impacts were evaluated for 14 wildlife species or species groups selected from the list of species likely to occur in the project area (Appendix A). A habitat-based evaluation system was used to assess the suitability of preconstruction, postconstruction, and recent habitat for the target species or species groups. Losses or gains to these species as a result of the hydroelectric-related components of the Cougar Project were calculated and are summarizxed in Table 17. Impacts resulting from the Cougar Project included the loss of winter range for Roosevelt elk, and the loss of year-round habitat for black-tailed deer, black bear, cougar, river otter, beaver, spotted owl, and other nongame species. Bald eagle and osprey were benefitted by an increase in foraging habitat.

Impacts to target species were measured by determining the difference between habitat units (HU's) prior to construction and after construction. HU's are a measure of the quantity (habitat area) and quality (suitability) of available habitat. One HU is equivalent to 1 acre of optimum habitat. In most cases the losses in HU's were greater immediately following project construction than when measured 15 years after completion of the project because of natural revegetation in the portion of affected area which was not inundated. These differences are discussed in the target species sections of the report. To simplify the summary table, however, only losses and gains which occurred from preconstruction to the more recent condition were addressed. The habitat units lost or gained represent the change in the potential of the habitat to support the given species at one point in time. That potential, however, was lost over the entire life of the project, a point which should be remembered when planning mitigation. It should also be noted that HU's lost or gained are not totaled among species. Each species was evaluated separately. When mitigation, enhancement, or

Table 17. Summary of impacts (preconstruction to recent) to target species as a result of the hydroelectric-related components of the Cougar Project, South Fork McKenzie River, Oregon.

Species (group)	Acres of habitat lost or gained a	Habitat Units lost or gained ab	Estimated No, animals lost or gained bc	Impacts
BI6 GAME				
Roosevelt elk	-1,520	-1,484	Unknown	Loss of winter habitat, Migration and movement inhibited or blocked. Increased disturbance.
Black-tailed deer	-1,520	, 9	Unknown	Loss of winter/summer habitat. Migration and movement inhibited or blocked, Increased disturbance.
Black-bear	,625	,856	Unknown	Loss of year-round habitat. Movement inhibited. Increased disturbance.
Cougar	-1,520	,	Unknown	Loss of habitat. Loss of habitat for prey species. Increased disturbance.
FURBEARERS				
River otter	-152	-189	-1 to 4 on South Fork, does not include tributary streams	Loss of year-round habitat. Movement inhibited or blocked,
Beaver	-232	-189	-46 to 87 on South Fork, does not include tributary streams	Loss of year-round habitat. Movement inhibited or blocked.
UPLAND GAME				
Ruffed Grouse	+67	-293	Unknown	Loss of riparian habitat.

Table 17 (cont.). Summary of impacts (preconstruction to recent) to target species as a result of the hydroelectric-related portions of the Cougar Project, South Fork McKenzie River, Oregon,

Species (group)	Acres of habitat lost or gained a	Habitat Units lost or gainedab	Estimated No. animals lost or gained bc	Impacts
WATERFOWL				
Barrow's goldeneye, common goldeneye, bufflehead, and comnon merganser	+1,000	0	Unknown	Loss of breeding habitat, Additional migratory resting habitat provided.
Harlequin duck	-280	-282	Unknown	Loss of breeding and preferred forage habitat
NONGAME SPECIES				
Yellow warbler	-63	-170	Unknown	Loss of breeding and migratory habitat.
American dipper	-296	285	Unknown	Loss of year-round habitat.
Pileated woodpecker	-1,600	-1,9 8	Unknown	Loss of year-round habitat, Increased disturbance.
Spotted owl	, 9	, 4	Unknown	Loss of year-round habitat. Movement probably inhibited. Increaseddisturance.
Bald eagle	795	+345	Unknown	Loss of nesting and roosting habitat. Increased disturbance. Foraging habitat increased
Osprey	795	+185	Unknown	Loss of nesting and perching habitat. Increased disturbance. Foraging habitat increased.

a From preconstruction (1953) to recent (1979).
b This number represents losses or gains at one point in time, not over the life of the project.
c Based on ODFW 1982 density estimates for Lane County.

protection measures are conducted, a single activity may improve the habitat for more than one species and would be credited for doing so. If it is not possible to mitigate in-kind (for the same species which experienced losses), out-of-kind mitigation, and hence trade-off mitigation may have to be negotiated. Benefits to bald eagles and ospreys, for example, may be credited against losses to other species during the process of establishing trade-off mitigation levels.

In most cases it was not practical or possible to estimate the number of animals lost or gained as a result of the project. Site specific wildlife population estimates prior to construction were not available. Density estimates were available for the McKenzie River drainage in 1948 (OSCG) for deer and grouse, but these figures were generalized and not representative of the actual losses which occurred at the Cougar Project. Density estimates for deer do not reflect the level of use the project area might have received during severe winter conditions and, thus, its long term importance to the deer population in the drainage. Evaluation of potential ruffed grouse habitat indicated a net increase of 67 acres; however, the quality of the habitat decreased to a level indicating net losses to grouse. Density estimates, therefore, could not be used in this case. The technique used in 1948 to estimate deer and grouse density was not documented. The estimates were made 8 years prior to initiation of project construction. Possibly the factor which most complicates the attempt to estimate the number of animals lost or gained as a result of the Cougar Project is the considerable change in conditions for wildlife in the Willamette Basin caused by timber harvesting and increased human use. The number of animals using the site at a given time does not adequately reflect the level of project impact because population fluctuations have occurred as a result of other factors. The potential of the affected area to support wildlife was altered as a result of the project and that change can be quantified in terms of HU's.

Impacts considered in this report were limited to effects of construction and operation of the hydroelectric-related components of the Cougar Project unless otherwise stated. These impacts would have occurred even if the project was not used for flood control or other nonhydroelectric purposes. Quantitative impacts considered were limited to the area directly affected by the project. Cumulative or system-wide impacts were not quantitatively assessed. Losses of wildlife and wildlife habitat resulting from increased human development as a result of the Willamette Reservoir System were not addressed. Indirect impacts such as degredation of habitat adjacent to the project site as a result of increased human development, recreational use, or blockage of anadromous fish passage were not measured.

No documentation was found nor were resource agency personnel aware of any mitigation, enhancement, or protection measures implemented by USACE at the Cougar Project to directly offset impacts to wildlife resulting from construction or operation of the project (Bedrossian et al. 1984). During consultation/coordination meetings, USACE representatives requested the Cougar loss statement acknowledge USACE's implementation of mitigation for anadromous fish.

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APPENDIX A

WILDLIFE SPECIES POTENTIALLY OCCURING IN THE COUGAAR DAM AND RESERVOIR PROJECT AREA [1]
(PRECONSTRUCTION AND/OR POSTCONSTRUCTION)

Herptiles

Northwestern salamander
Long-toed salamander
Cope's giant salamander
Pacific giant salamander
Olympic salamander
Clouded salamander
Oregon slender salamander
Ensatina
Dunn's salamander
Larch mountain salamander
Western redback salamander
Roughskin newt
Western toad
Pacific tree frog
Tailed frog
Red-legged frog
Foothill yellow-legged frog
Cascade frog
Bullfrog
Spotted frog
Western pond turtle
Northern alligator lizard
Short-horned lizard
Western fence lizard
Western skink
Rubber boa
Racer
Sharptail snake
Ringneck snake
Gopher snake
Western terrestrial garter snake
Northwestern garter snake
Comnon garter snake
Western rattlesnake

Birds

Comnon loon
Pied-billed grebe
Horned grebe
Red-necked grebe
Eared grebe
Western grebe
Double-crested cormorant
American bittern
Great blue heron
Great egret
Green-backed heron
Greater white-fronted goose
Canada goose
Wood duck
Green-winged teal
Mallard
Northern pintail
Blue-winged teal
Cinnamon teal
Northern shoveler
Gadwall
American wigeon
Canvasback
Redhead
Ring-necked duck
Greater scaup
Lesser scaup
Harlequin duck
Comnon goldeneye
Barrow's goldeneye
Bufflehead
Hooded merganser
Comnon merganser
Ruddy duck
Turkey vulture
Osprey
Bald eagle
Northern harrier
Sharp-shinned hawk
Cooper's hawk
Northern goshawk
Red-tailed hawk
Golden eagle
American kestrel
Merlin
Peregrine falcon
Prairie falcon
Ring-necked pheasant
Blue grouse
Ruffed grouse
California quail
Mountain quail

1 Based on species list for reproductive habitat. Willamette National Forest and Oregon Nongame Wildlife Management Plan, review draft.

Birds (Continued)

Virginia rail
Sora
American coot
SAndhill crane
Killdeer
Greater yellowlegs
Solitary sandpiper
Spotted sandpiper
Western sandpiper
Least sandpiper
Baird's sandpiper
Dunlin
Long-billed dowitcher
Common snipe
Wilson's phalarope
Ring-billed gull
Western gull
Black tern
Rock dove
Band-tailed pigeon
Mourning dove
Barn owl
Western screech owl
Great horned owl
Northern pygmy owl
Spotted owl
Barred owl
Great gray owl
Long-eared owl
Northern saw-whet owl
Common nighthawk
Black swift
Vaux's swift
Calliope hummingbird
Rufous hummingbird
Allen's hummingbird
Belted kingfisher
Lewis' woodpecker
Red-breasted sapsucker
Williamson's sapsucker
Downy woodpecker
Hairy woodpecker
White-headed woodpecker
Three-toed woodpecker
Black-backed woodpecker
Northern flicker
Pileated woodpecker
Olive-sided flycatcher
Western wood pewee
Willow flycatcher
Hammond's flycatcher
Dusky flycatcher
Western flycatcher
Western kingbird
Horned lark
Purple martin
Tree swallow
Violet-green swallow
Northern rough-winged swallow
Bank swallow
Cliff swallow
Barn swallow
Gray jay
Steller's jay
Scrub jay
Clark's nutcracker
American crow
Common raven
Black-capped chickadee
Mountain chickadee
Chestnut-backed chickadee
Bushtit
Red-breasted nuthatch
White-breasted nuthatch
Pygmy nuthatch
Brown creeper
Rock wren
Canyon wren
Bewick's wren
House wren
Winter wren
Marsh wren
American dipper
Golden-crowned kinglet
Ruby-crowned kinglet
Western bluebird
Mountain bluebird
Townsend's solitaire
Swainson's thrush
Hermit thrush
American robin
Varied thrush
Wrentit
Water pipit
Bohemian waxwing
Cedar waxwing
European starling
Solitary vireo
Hutton's vireo
Warbling vireo
Red-eyed vireo
Tennessee warbler
Orange-crowned warbler
Nashville warbler

Birds (Continued)

Yellow warbler
Black-throated blue warbler
Yellow-rumped warbler
Black-throated gray warbler
Townsend's warbler
Hermit warbler
American redstart
MacGillivray's warbler
Commn yellowthroat
Wilson's warbler
Yellow-breasted chat
Western tanager
Black-headed grosbeak
Lazuli bunting
Green-tailed towhee
Rufous-sided towhee
Brown towhee
Chipping sparrow
Brewer's sparrow
Vesper sparrow
Savannah sparrow
Fox sparrow
Song sparrow
Lincoln's sparrow
Golden-crowned sparrow
White-crowned sparrow
Harris' sparrow
Dark-eyed junco
Red-winged blackbird
Western meadowlark
Brewer's blackbird
Brown-headed cowbird
Northern oriole
Rosy finch
Pine grosbeak
Purple finch
Cassin's finch
House finch
Red crossbill
White-winged crossbill
Pine siskin
Lesser goldfinch
American goldfinch
Evening grosbeak
House sparrow

Mammals

Virginia opossun
Vagrant shrew
Dusky shrew
Pacific shrew
Water shrew
Pacific water or Marsh shrew
Trowbridge's shrew
Shrew-mole
Townsend's mole
Coast mole
Little brown myotis
Yuma myotis
Long-eared myotis
Fringed myotis
Long-legged myotis
California myotis
Silver-haired bat
Big brown bat
Hoary bat
Townsend's big-eared bat
Pallid bat
Pika
Brush rabbit
Snowshoe hare
Mountain beaver
Yellow-pine chipmunk
Townsend's chipmunk
Siskiyou chipmunk
Yellow-bellied marmot
California ground squirrel
Golden-mantled ground squirrel
Western gray squirrel
Douglas' squirrel
Northern flying squirrel
Botta's pocket gopher
Western pocket gopher
Beaver
Deer mouse
Dusky-footed woodrat
Bushy-tailed woodrat
Western red-backed vole
Heather vole
White-footed vole
Red tree vole
Townsend's vole
Long-tailed vole
Creeping vole
Water vole
Muskrat
House mouse
Pacific jumping mouse
Porcupine
Nutria
Coyote
Red fox
Gray fox
Black bear
Raccoon

Mammals (Continued)

Marten
Fisher
Ermine
Long-tailed weasel
Mink
Wolverine
Badger
Western spotted skunk
Striped skunk
River otter
Mountain lion
Lynx
Bobcat
Roosevelt elk
Mule deer
Black-tailed deer

APPENDIX B

Interagency Habitat Evaluation Group
Cougar Project

Name	Agency
Liz Agpaoa	USFS
Karen Bedrossian	ODFW
Charlie Bruce	ODFW
Geoff Dorsey	USACE
Brian Ferry	ODFW
Larry Gangle	USFS
Jim Greer	ODFW
Ed Harshman	USFS
Ken Kestner	USFS
Ron Meclenberg	USFS
Jim Noyes	ODFW
Mary Potter	ODFW
Pat Wright	USFWS

APPENDIX C

Comments

(1) State agency (ODFW)

(2) Federal agencies (USFWS and (USFS)

(3) Tribes

No tribes are involved with the actions taken at the Cougar Project.

(4) Facility operator (USACE)

BPA requested comments on the April 1985 Cougar draft report by 26 July 1985. USACE had not submitted comments by 3 September 1985 when the final report was typed; therefore, USACE comments could not be incorporated into the report.

(5) Other (PNUCC)

JUL 29 1985

ODFW Comments:

Department of Fish and Wildlife

506 S.W. MILL STREET, P.O. BOX 3503, PORTLAND, OREGON 97208

July 23, 1985

Mr. James R. Meyer
Division of Fish and Wildlife
Bonneville Power Administration
PO Box 3621
Portland, OR 97208

Dear Mr. Meyer:

The following comments respond to your request, dated 21 June 1985, to review the Loss Assessment Report for Cougar Dam and Reservoir Project.

The Cougar Loss Assessment presents an analysis of the impacts to wildlife and wildlife habitat resulting from the construction and operation of the hydroelectric-related components of the project. The Cougar Project inundated, extensively altered, or directly affected 3,096 acres of land and river in the McKenzie River drainage. Impacts to wildlife centered around the loss of 1,587 acres of old-growth forest and 195 acres of riparian hardwoods. Important Roosevelt elk winter range was lost, as was year-round habitat for black-tailed deer, black bear, cougar, river otter, beaver, spotted owl, and other nongame species. Impacts of the project included: blockage or inhibition of animal migration or movement; loss of thermal and/or hiding cover; alteration of open area and cover interspersion; loss of breeding, parturition and/or rearing habitat; fragmentation of contiguous habitat; loss or alteration of available forage; loss of nesting, perching and/or roosting sites; and avoidance of the project area by wildlife during construction.

The Cougar Loss Assessment clearly shows the potential of the area to support wildlife was altered as a result of the project. That change was quantified in terms of Habitat Units. In this study, the Habitat Units lost or gained represent the change in the potential of the habitat to support the given species at one point in time. That potential, it should be emphasized, was lost over the entire life of the project. Habitat Units also may serve as a guide toward developing mitigation plans, as well as provide a method of measuring the success of mitigation implementation.

The Oregon Department of Fish and Wildlife has a legal mandate "To maintain all species of wildlife at optimum levels and prevent the serious depletion of any indigenous species," and "To develop and manage the lands and waters of this state in a manner that will enhance the production and public enjoyment of wildlife." In accordance with this mandate, the Oregon Department of Fish and Wildlife has a policy to request mitigation when losses to animal populations and habitat result from project construction and operation. These policies are consistent with the Northwest Power Planning Act and Wildlife Program purpose "to protect, mitigate, and enhance fish and wildlife to the

Explanations or Modifications:

No explanations or report modifications necessary

ODFW Comments (cont.):

extent affected by the development and operation of any hydroelectric project of the Columbia River and its tributaries..."

In order to "protect, mitigate, and enhance" wildlife resources affected by hydroelectric generating facilities, it is necessary to develop and implement mitigation plans. The Cougar Loss Assessment represents the beginning of the process to achieve mitigation for the impacts to the wildlife resource resulting from construction of the project. The next step in the Council's Wildlife Program is the preparation of mitigation plans. I strongly urge the participating agencies to move forward in implementing the Wildlife Program of the Northwest Power Planning Council. The Oregon Department of Fish and Wildlife is ready to take the lead in developing a mitigation plan for the Willamette Basin. Consultation and coordination with the appropriate agencies involved in the project will be an integral part of the process. The Northwest Power Planning Act and the Power Council's Fish and Wildlife Program have provided the opportunity to correct past misunderstanding and shortsightedness regarding wildlife resources affected by the development and operation of hydroelectric power in the Columbia River Basin. The Oregon Department of Fish and Wildlife wants to see that opportunity realized to the fullest degree possible in a timely, effective, and cost-efficient manner.

I appreciate your assistance in this program and look forward to working with you in a cooperative way to achieve our mutual objectives.

Sincerely,

for John R. Donaldson, PhD
Director

Explanations or Modifications (cont.):

No explanations or report modifications necessary.

USFWS Comments:

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Division of Ecological Services
Portland Field Office
727 N. E. 24th Avenue
Portland, Oregon 97232

Reference PW:mm

September 13, 1985

Mr. John Palensky, Director
Division of Fish and Wildlife
Attn: James Meyer
Bonneville Power Administration
P. O. Box 3621
Portland, Oregon 97208

Dear Mr. Palensky:

We have reviewed the draft loss statement reports for Cougar, Hills Creek, Dexter, and Lookout Point hydroelectric projects. The following comments are being provided for inclusion in each of the final loss statements.

In our opinion, the reports are well written and adequately describe the on-site wildlife impacts of each project. A comprehensive evaluation, based on habitat supported by population data when available, was conducted by a diverse team of wildlife biologists familiar with the area's wildlife resources. Our agency actively participated in each evaluation and we believe the methods employed to identify the wildlife impacts at each project resulted in a fair and accurate analysis of project impacts.

It is important to note that during each of the evaluations, the impacts were identified on a concensus basis by the evaluation team. This format provided for a thorough discussion of impacts, both beneficial and adverse, and provided a forum for resolving differences in a manner mutually acceptable to each agency's team representative. To the best of our knowledge, the impacts identified in the loss statements accurately reflect both the discussions and decisions of the evaluation teams.

The evaluations did not address cumulative impacts that these and the other major Willamette Valley hydroelectric projects may have had on wildlife. We believe the extensive development that has occurred along the Willamette River's floodplain has significantly reduced a variety of wildlife habitats and related resources. In our opinion, that development and resultant wildlife losses would have been considerably less without the construction and operation of the aforementioned hydroelectric projects. Accordingly,

Explanations or Modifications:

No explanations or report modifications necessary.

USFWS Comments (cont.):

the Power Council, BPA, and the Corps of Engineers, together with the wildlife management agencies should address the cumulative impacts of the major Willamette Basin hydroelectric projects on wildlife.

In conclusion, we believe the magnitude of on-site wildlife losses identified in the loss statements for the Cougar, Hills Creek, Dexter, and Lookout Point hydroelectric projects warrants that mitigation planning be initiated as early as possible as provided for in the Power Council's Fish and Wildlife Program. We are eager to assist in these efforts and look forward to the day when on-the-ground mitigation can be implemented.

Sincerely,

Russell D. Peterson

Russell D. Peterson
Field Supervisor

Explanations or Modifications:

No explanations or report modifications necessary.

USFS Comments:

United States Department of Agriculture — Forest Service

JUL 11 1985

Explanations or Modifications:

2600
July 25, 1985

James R. Meyer, Wildlife Program Area Manager
Biological Studies Branch
Department of Energy
Bonneville Power Administration
P. O. Box 3621
Portland, OR 97208

Dear Mr. Meyer:

Our Forest Wildlife Biologist, Ed Marshman, has reviewed the drafts for Cougar, Hills Creek, and Lookout Point reservoirs and has transmitted corrections directly to Karen Bedrossian, Oregon Department of Fish and Wildlife.

Corrections or modifications were made where applicable.

Regarding the meeting on July 11, concerning mitigation plans, we urge all possible speed in completing these plans so they can be incorporated into our Forest Land Use Plan.

Sincerely,

for MICHAEL A. KERRICK
Forest Supervisor

DO/EM.62P/072585

PNUCC Comments:

JUL 30

PNUCC

PACIFIC NORTHWEST UTILITIES CONFERENCE COMMITTEE

July 29, 1985

Mr. John R. Palensky - PJ
Director, Division of Fish and Wildlife
Bonneville Power Administration
1002 N.E. Holladay
P.O. Box 3621
Portland, Oregon 97208-3621

Dear Mr. Palensky:

This letter comprises the Pacific Northwest Utilities Conference Committee's (PNUCC) review of the Wildlife and Wildlife Habitat Loss Assessments prepared by Oregon Department of Fish and Wildlife for Dexter Dam, Lookout Point Dam, and Hills Creek Dam on the middle fork of the Willamette River, and Cougar Dam on the south fork of the McKenzie River. Our major technical comments are outline below.

1. The objectives of the impact assessments have not been stated. It is not clear whether the authors intended a general, overall impact assessment, or whether they were interested in specific resource categories such as a habitat type or a species. The presentation of the results seems too detailed and specific for a general assessment, but the resource categories for a specific evaluation are unclear. The focus appears to be species since the habitat units were evaluated across cover types for each species. However, the discussion at the consultation meeting on July 11 suggested that, at least in some cases, the resource category of interest was habitat. As an example, the authors may have selected to investigate losses of species such as plieated woodpeckers, bald eagles, and yellow warblers. Or they may have selected to investigate losses of old growth forest, bald eagles, and certain passerines, a combination of species categories including a guilding method, and habitat categories. Although the same species and selection criteria may be used in either approach, the goals and objectives for a mitigation plan and the plan which results will differ considerably. It is important to identify goals and objectives at the outset since initiating the loss assessments without first identifying objectives may produce costly and unnecessary information, may fail to produce required information, and could lead to a lack of understanding and continuity between interested parties, through personnel changes, and over long-term projects. The potentially high cost of wildlife programs make the requirement of clearly documented objectives especially crucial.

2. The authors used a technique called a "modified" Habitat Evaluation Procedure (HEP) and presented their results in terms of Habitat Units (HU). HEP is a published procedure and modifications of this procedure should be precisely identified and documented. The validity of new and altered assumptions should be discussed. For example, one of the modifications in these reports is a backward projection of baseline conditions from a "future" target year. In a usual HEP, using aerial photos, one ground truths baseline habitat conditions as a standard procedure. Aerial photos, even infrared photos, are of limited value without this step. Future projections can also be verified by monitoring conditions after the impact. The backward projection

Explanations or Modifications:

Objectives of the impact assessments are stated in the introduction.

The method used was a habitat-based assessment, using target species to evaluate habitat. See Sections III.D. and III.E.

Objectives of the impact assessments are stated in the Introduction. Objectives of mitigation plans will be stated early in the planing process.

The procedure used was not "called a 'modified' Habitat Evaluation Procedure (HEP)." The procedure was based on HEP, other studies, and discussions with various agency personnel, including USFWS. See Section III.E.
Cover type maps of recent habitat conditions were ground truthed. See Section III.B.

PNUCC Comments (cont.):

can never be ground truthed, or linked in any way to on-site population estimates. Further problems arise in using historical photos. The HEP procedure assumes the project site is evaluated under "average" habitat conditions. Information from aerial photos will vary according to the time of year of the flight and long-term climatic cycles. The loss assessments do not indicate that these variables were taken into account. Therefore, the backward projection adds additional unverifiable assumptions that may limit the procedure and should be stated and discussed.

3. The Habitat Suitability Index models in a HEP are the most controversial and important part of the procedure. The models, or "rating criteria" used in this study are not described in these reports. A model may be either qualitative or quantitative, but it must be documented and it must include as much verification and testing as possible. Models must be repeatable to be credible. A margin of error of repeatability should be provided. Likewise, the sampling design and techniques used to ground truth the aerial photos and apply the models must be described. Sample sizes should be included. The sampling procedure must also produce repeatable results within a stated margin of error and the design must satisfactorily reflect habitat conditions. A specific problem that arises in these loss assessments is the frequent result that more acres of "ideal habitat" ("HUs") than of actual habitat is claimed to have been lost. The authors seem to be indicating that different zones of habitat were variably impacted by the hydropower portion of the project such that some acres were "lost" while others were "altered." This could be a controversial claim but it cannot be evaluated since the HSI models, or rating criteria, and sampling procedures are not described.

4. HEP is based on certain assumptions including the assumption that HSI correlates linearly with carrying capacity. It is also assumed that carrying capacity is full so that habitat is limiting. A projection of the Willamette Basin loss assessments to population numbers would give an estimate of a decline in species such as elk, deer, beaver, and others, and an increase in, for example, the bald eagle. Actual population trends during the 1950s and 1960s when the projects came on line indicate the reverse: deer, elk, beaver, and some others increased or maintained populations, and bald eagles decreased in the Willamette Valley.1/ It appears the HEP assumptions are invalid in this case. Habitat replacement cannot be supported if there are no documented wildlife losses as a result of the projects.

5. We are concerned about how the "losses" in the impact assessments relate to the land management and wildlife agencies' established goals and objectives for wildlife in the Willamette Basin. Willamette National Forest, the major land manager in the area of these projects, will be including targets for many species in their Forest Plan.2/ Wildlife goals under the Council's program must be consistent with the Forest Service targets and other existing state and federal programs. For example, the present management strategies of the Oregon Department of Fish and Wildlife suggest that Willamette Basin game populations are healthy rather than depressed.

1/Pacific Northwest River Basins Commission (1969) Willamette Basin Comprehensive Study of Water and Related Land Resources, App. D Fish and Wildlife.

2/Willamette National Forest draft Forest Plan is due by the end of Fiscal Year 1985.

Explanations or Modifications (cont.):

No attempt was made to link habitat conditions to on-site population estimates.
Cover types identified from aerial photos will not vary from year to year, however, wildlife population size will. See Summary, Section V. for discussion of population estimates and habitat conditions.
See Section III.E. for discussion of rating criteria. Target species rating criteria worksheets are available from ODFW.

For some species, the loss of HU's exceeded the direct loss of acres of habitat. This was a result of the loss of acreage plus the degradation in the quality of the remaining habitat.

Population trends for the Willamette Valley do not necessarily reflect conditions at the project site. See Summary. Section V., for discussion.

Objectives will be identified early in the mitigation planning process. All appropriate agencies will be invited to participate in the development of these objectives.

PNUCC Comments (cont.):

We hope these comments will contribute to a useful and informative final document. Thank you for the opportunity to review the reports.

Sincerely,

Kathryn Kostow

Kathryn E. Kostow
Fish and Wildlife Specialist

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cc: Karen Bedrossian, ODFW
Jan Chrisman, NWPPC
Marty Montgomery, NWPPC
Jim Meyer, BPA

Explanations or Modifications (cont.):

No explanations or report modifications necessary.